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BRODY (H. W.). **The Effects of Leafhopper Injury and certain Spray Materials on the Rates of Photosynthesis and Transpiration of Stayman-Winesap Apple Leaves.**—*Abstr. doct. Diss. Ohio Univ.* no. 36 pp. 25–28. Columbus, Ohio, 1942.

A brief account is given of experiments already noticed showing that feeding by Jassids reduces the photosynthesis and transpiration of apple leaves [*cf. R.A.E.*, A **30** 537; **31** 170], and of similar determinations of the effect of spray materials. Nicotine sulphate at 1 : 1200 alone and a summer spray oil, with or without nicotine sulphate or a fixed nicotine, reduced the rates of photosynthesis and transpiration of the leaves without visible injury. A second application of oil was usually more harmful. Metabolic activity was recovered, however, in 6–21 days. Eight applications of a tank mixture of 1 U.S. pint nicotine sulphate, 5 lb. bentonite, 1 U.S. quart soy-bean oil and ½ oz. commercial soap (Dreft) [per 100 U.S. gals. water] at intervals of 4 days reduced photosynthesis by 36·3 per cent. and transpiration by 20·5 per cent., and the film deposited by eight applications on a sheet of cellophane reduced the transmission of incident light by about 60 per cent. Since the injury due to Jassids is permanent and that to sprays temporary, it is concluded that the use of sprays is justified, especially if applied early in the season.

FERGUSON (G. R.). **The Effect of sublethal Doses of Basic Copper Arsenate on Growth and Reproduction of the Southern Armyworm** *Prodenia eridania* **(Cram.).**—*Abstr. doct. Diss. Ohio Univ.* no. 36 pp. 95–101, 7 refs. Columbus, Ohio, 1942.

In view of the lack of information on the effect on subsequent development and reproduction of sublethal doses of stomach poisons ingested by insect larvae, laboratory tests were carried out in Ohio in which a dust of basic copper arsenate was applied to bean leaves, and areas of the latter bearing known doses were fed to sixth-instar larvae of *Laphygma* (*Prodenia*) *eridania*, Cram., with a weight-range of 300–400 mg. After the poisoned food had been consumed, the larvae were allowed to feed on untreated leaves in cages. The percentage mortalities that resulted from doses of 0·12, 0·14 and 0·16 mg. per gm. body weight were 20, 43·3 and 65·5, respectively, and further tests confirmed that the dose required to kill 50 per cent. (median lethal dose) is close to 0·15 mg. per gm. Among the larvae that survived doses of 0·05, 0·1 and 0·15 mg. per gm., the growth rate and the weight of the pupae were somewhat reduced, but pupal development was not affected, and though adults from larvae that survived the median lethal dose gave rise to fewer eggs than untreated individuals, the percentage that hatched was little affected.

In further experiments, the larvae were fed until death or pupation on bean leaves treated with known dosages of basic copper arsenate. Dosages of 0·005 mg. or more per sq. cm. killed all the larvae, the time of survival and the total amount of poison consumed per larva decreasing as the dosage increased. Exposure to 0·0025 mg. per sq. cm. resulted in complete mortality in the larval or pupal stage if the larvae had not attained a weight of 300–400 mg., but most of those that had done so gave rise to adults, which, however, were completely sterile. Larvae reared on foliage treated with 0·00125 mg. per sq. cm. showed a reduced gain in weight, a lower maximum weight and a longer period of larval development, but the duration of the pupal stage was not affected. The adults were fertile, though the number of eggs laid was reduced, but exposure in the fifth or early sixth instar resulted in almost complete sterility. Exposure to half this dosage did not affect fertility. A comparative test with acid lead arsenate at a dosage of ·00125 mg. per sq. cm. gave results similar to those with basic copper arsenate at the same dosage.

(1058) Wt. P11/3728 1,500 8/43 S.E.R. Ltd. **Gp. 432.** [A]

MARSHALL (G. E.). **The Application of Twig Clipping supported by certain other sanitary and cultural Practices in the Control of the Oriental Fruit Moth** *Laspeyresia molesta* **Busck.**—*Abstr. doct. Diss. Ohio Univ.* no. 36 pp. 227–230. Columbus, Ohio, 1942.

Since effective control of *Cydia* (*Laspeyresia*) *molesta*, Busck, on peach in certain districts of Indiana is not given by introduced parasites or insecticides, the effect was tested of the regular removal and destruction of infested twigs and fruits during the growing season. The percentage infestation of the fruit in the experimental orchard was 25 in 1935, before the test was begun, but in 1937 and 1938, visible infestation was only 2·6 and 1·5 per cent., respectively. In 1939, clipping was performed only until mid-June, as the number of infested twigs was then very small, but infestation at harvest rose to an average of 13 per cent. of the crop. Experience has shown that the orchard to be treated should be isolated from other peach and apple plantings and that the entire orchard should be worked over at least every 5 days from early spring until less than a month before harvest. In the years under review, the method is shown to have been economically profitable.

LINDGREN (D. L.) & DICKSON (R. C.). **Fumigation Experiments on the Black Scale.**—*Calif. Citrogr.* **28** no. 4 pp. 90, 98–99, 2 graphs, 4 refs. Los Angeles, Calif., 1943.

The following is largely based on the authors' summary of this account of laboratory experiments carried out over several years with a fumigation chamber of 100 cu. ft. capacity at 75°F. and an exposure of 40 minutes to determine the differences in resistance to hydrocyanic acid gas of strains of the black scale [*Saissetia oleae*, Bern.] from various *Citrus* areas in southern California. There was no definite difference in susceptibility to fumigation between eggs under the female on the food-plant and eggs in open dishes, between recently laid eggs and those just ready to hatch [*cf. R.A.E.*, A **28** 618], or between eggs obtained from females of resistant and susceptible strains. Scales of a susceptible strain became somewhat more resistant to fumigation when they reached the "rubber" stage, which corresponds to field experience. The difference in susceptibility between resistant and non-resistant strains was great and is apparently much more pronounced than in the red scale [*Aonidiella aurantii*, Mask.]. In general, the eggs were intermediate in susceptibility between resistant and non-resistant scales one-half to two-thirds grown, but more susceptible than non-resistant scales in the "rubber" stage. Scales preconditioned at 50 and 90°F. for a few hours prior to fumigation were equally susceptible but slightly more difficult to kill than those preconditioned at 75°F. Attempts to demonstrate protective stupefaction [*cf.* **20** 32] were unsuccessful.

FLANDERS (S. E.). **The Argentine Ant versus the Parasites of the Black Scale.**—*Calif. Citrogr.* **28** no. 5 pp. 117, 128, 137, 1 fig., 18 refs. Los Angeles, Calif., 1943.

The author reviews from the literature cases in which the presence of the Argentine ant [*Iridomyrmex humilis*, Mayr] has increased the infestation of crop plants by Aphids or Coccids in various parts of the world and others in which it has not. Though the pests are favoured directly by the attendance of the ant, their increase is promoted most by the protection afforded against insect parasites and predators. This depends on the density and activity of the ants and on the feeding and oviposition habits of the several natural enemies. Predators and parasites that must feed on the adult stage of the host in order to produce eggs are the most affected by the interference of the ants. The activity of other parasites is reduced in proportion to the time required to deposit their eggs.

The effect of the ant on the parasites of the black scale [*Saissetia oleae*, Bern.] on *Citrus* in California is discussed at length. *Metaphycus lounsburyi*, How., which became well established in all the areas infested with *S. oleae* does not afford satisfactory control on *Citrus*, since it soon brings about an even-hatch condition of the host [*cf. R.A.E.*, A **31** 245], but it is effective on *Schinus molle*, on which the scale exhibits a pronounced tendency to uneven development. Localised infestations of *S. molle* occur only where the ant is abundant, and its presence on this tree does not prevent heavy parasitism of *S. oleae* by *Coccophagus capensis*, Comp., *C. rusti*, Comp., and *C. trifasciatus*, Comp., all of which oviposit rapidly and do not feed as adults on the host.

The effectiveness of *M. helvolus*, Comp., is handicapped by the ant because the adult feeds on the Coccid and requires several minutes to deposit a single egg [*cf. loc. cit.*]. It is more effective in areas in which the winter temperatures are low, as they reduce the activity of the ants. In the absence of the latter, it can prevent serious infestation by the Coccid, owing to its great searching capacity and egg production [*cf.* **31** 90]. In areas in which an even-hatch condition of the Coccid occurs, it is important that *M. helvolus* should be abundant during the winter when the scale is most suitable for oviposition. The females feed on the maximum number of scales in autumn when the ant is active. Groups of larger scales, in which the parasite should oviposit, attract the ants by their greater supply of honey-dew, and the interference of the latter with the work of *M. helvolus* may result in a serious increase of the scale.

M. luteolus, Timb., which parasitises the soft brown scale [*Coccus hesperidum*, L.] is similar to *M. helvolus* in size and habits, but is much less affected by the presence of the ant, because the adults are less dependent on feeding on the host and there is a continuity of host stages suitable for oviposition ; and *M. stanleyi*, Comp., is able to parasitise a high percentage of this Coccid in the presence of the ant, since it lays its eggs rapidly.

The author has found that the ants can be kept away from the trees for several days by surrounding the base with several shovelfuls of powdered canal silt and rubbing it on the trunk.

SHAW (J. G.) & DOUGLASS (J. R.). **Life History, Habits, and Control of the Beanstalk Weevil (*Sternechus paludatus*) in the Estancia Valley, New Mexico.**—*Tech. Bull. U.S. Dep. Agric.* no. 816, 35 pp., 19 figs., 5 refs. Washington, D.C., 1942.

Since 1927, *Sternechus paludatus*, Casey, has caused increasing injury to beans, which it stunts and sometimes kills, in the foothills of the Manzano Mountains, which border the Estancia Valley, New Mexico, on the west. All stages of this weevil are described. Its native food-plant is probably the New Mexican locust tree (*Robinia neomexicana*), which is the only known wild one, but in the laboratory it also fed on lucerne in addition to beans. Studies of its life-history, made at Estancia in 1929–34 by a technique that is described, showed that it has one generation a year and overwinters only in the adult stage, which lasts rather more than a year. Overwintering is successful in the forest pine zones or in the valley, according to weather conditions. The weevils leave their hibernation quarters early in May, when the temperature reaches about 45°F., and begin to feed on *Robinia*, migrating to bean plants as soon as these come up. The females, which paired and oviposited only after they had overwintered, laid about 200–300 eggs singly in the stems or petioles of beans. Oviposition occurs from May to September, but chiefly in July, and is heaviest at high temperatures during daylight. Immediately after hatching, the larva enters the stem and tunnels up or down in it ; when full-fed, it bores through it, at or near the soil level, and enters the ground to pupate. The egg, larval, prepupal and pupal stages lasted 5·2–6·9, 21·2–29·3, 6·1–7·8 and 11·6–15·9 days,

respectively. On *Robinia*, the eggs are laid in the terminal growth, and the larvae bore in the pith of the twigs and drop from them to the ground when mature.

In cages in a cellar, hibernating weevils were attacked by *Beauveria* (*Sporotrichum*) *globulifera*, and pupae and newly emerged adults by a species of *Fusarium*. Dead larvae infested by an undetermined fungus were found in the field, and eggs were destroyed by an unidentified thrips and by nymphs of *Orius insidiosus*, Say. Insecticides were tested against overwintered adults on potted bean plants. In 1932, zinc arsenite and barium fluosilicate, applied undiluted as dusts, gave about 80 and 87 per cent. mortality and were more effective than lead, magnesium or calcium arsenates or sodium fluosilicate, and in 1933, zinc arsenite was the most effective of these compounds whether they were applied undiluted or at the rate of 4 lb. per 100 U.S. gals. water. Barium fluosilicate had an immediate effect and zinc arsenite a delayed one; sodium fluosilicate was the least toxic in every instance. Undiluted cryolite gave 66·6 per cent. kill in 1933, and contact dusts (derris or cubé) were ineffective. No foliage injury was observed in any of the tests, and no field experiments were carried out.

BEAL (J. A.) & MASSEY (C. L.). **Two important Pests of Hickory Reproduction in the Southeast.**—*J. For.* **40** no. 4 pp. 316–318, 1 ref. Washington, D.C., 1942.

Examination of young hickory trees in a forest in North Carolina in which numerous terminal shoots were dead or dying in the autumn of 1939 showed that most of the damage was due to the Lamiid, *Oncideres cingulatus*, Say, and the Buprestid, *Agrilus arcuatus torquatus*, Lec., though a few larvae of the Cerambycid, *Elaphidion* (*Hypermallus*) *villosum*, F., were also involved. Notes are given on the bionomics of the Buprestid [*R.A.E.*, A **15** 78], adults of which emerge each year though the life-cycle lasts two years. The adults of the Lamiid appear in late August and early September and feed upon the young bark and the tips of the twigs. The females lay their eggs singly beneath the bark and then girdle the twigs containing them. Many of the girdled twigs are broken off by wind, but some persist on the tree for over a year. The larvae hatch in about three weeks and feed sparingly; they overwinter while still small, feed in the wood in the following spring, and pupate in mid-August. Other food-plants in this area are persimmon, elm, honey locust tree [*Gleditsia triacanthos*], hop hornbeam [*Ostrya*], hackberry [*Celtis*] and redbud [*Cercis canadensis*].

The effect of infestation on hickory reproduction was studied in 1940–41 in ten plots each containing 50 young trees 1–10 ft. in height. In 1940, the main stem was completely or partly destroyed by *Oncideres* in 11·6 per cent. of the trees and by *Agrilus* in 6·6 per cent.; larvae of both species were only once found in the same shoot. The average age and diameter of the twigs killed by each species, together with the average length of twig destroyed, are shown in a table. Dead leading shoots are generally replaced by a lateral twig or by new shoots, resulting in badly shaped trees, which are common throughout the forest. Evidence of up to 10 attacks was observed on trees only 10 ft. high, and trees may continue to be attacked throughout their life. In addition to the direct injury, the entry of fungi is facilitated at the damaged points, and these may kill a further length of the twig and even the roots of young trees in which the stem has been killed almost to ground level. Infestation of the laterals does not cause serious damage, but is important in increasing the numbers of beetles.

The mortality of *Oncideres* during its development was studied in 1941 from observations made in mid-June and early August. The number of eggs present in an infested twig varied from 1 to 17 and averaged 5·5; some girdled

twigs contained none. The length of the severed twigs varied from 15 to 90 cm. and averaged 50 cm. The percentage mortality was 40–56 among eggs and 67–75 among larvae, and total mortality of the immature stages exceeded 80 per cent. in twigs still on the trees and 90 among those on the ground. The causes of this high mortality are not known ; parasitism of 5 per cent. was observed, but it is probably much higher, and it is thought that desiccation of the eggs is the most important single factor. Parasites reared from larvae of *Oncideres* comprised *Eurytoma magdalidis*, Ashm., two species of *Iphiaulax*, one of which was probably *I. agrili*, Ashm., an undescribed species of *Horismenus*, and two apparently undescribed species of *Heterospilus* ; the predacious Clerid, *Cymatodera undulata*, Say, was also reared. A few parasites were observed in larvae of *Agrilus*, but attempts to rear them were unsuccessful. A list is given of the Coleoptera that are associated with *Oncideres* and *Agrilus* in the twigs but have no influence on the damage caused.

No method of control satisfactory under forest conditions is known, but removal of old hickory trees from the vicinity of reproduction would probably protect the young trees from serious damage.

Preventing Damage to Buildings by Subterranean Termites and their Control.—*Fmrs' Bull. U.S. Dep. Agric.* no. 1911, 37 pp., 31 figs. Washington, D.C., 1942.

This bulletin, which supersedes a previous one [*R.A.E.*, A **23** 216, etc.], contains information on the measures recommended for the prevention of damage to timber in buildings by the subterranean termites, comprising species of *Reticulitermes*, *Heterotermes* and *Amitermes*, that are injurious in the United States, and on control measures for use in infested buildings, together with notes on the habits of these termites, their distribution in the United States, the types of material damaged by them, the recognition of their presence, and the conditions that favour infestation.

Any nests present on a building site should be destroyed, and all wood in or on the soil cleared away. No wood débris should be allowed to become buried during the work, and all form boards and grade stakes should be removed. The best protection against infestation is afforded by so constructing the building that termites have no means of entry, and almost two-thirds of the bulletin is devoted to appropriate building specifications. They provide for an impenetrable foundation, avoidance of all contact between woodwork and soil or filling materials, thorough drainage of the site, ventilation openings in the foundation to prevent dead-air pockets and ensure frequent changes of air, and sufficient space beneath wooden substructures to enable regular inspections to be made. Metal termite shields [**17** 730] should be used only where it is impossible to comply with the structural recommendations or if it is desired to employ every possible means of avoiding infestation. Mistakes commonly observed in termite shields include insufficiently sealed joints, unsealed bolt-holes, the use of metals that are readily corroded, bent or torn, insufficient clearance between the outer edge of the shield and adjacent wood or piping, and errors in judgment as to the points most likely to be attacked. Recent laboratory experiments have shown that none of the shields yet developed constitutes an entirely effective barrier, but when properly constructed and installed, they eliminate the risk of hidden attack by forcing the termites into the open. To be effective, they should be of an impenetrable material, in practice generally copper or galvanised iron, with a slippery or polished surface. The outer edge should be smooth and as thin as possible ; this makes it difficult for the termites to extend their tubes from the lower to the upper surface and appears to be the most effective feature involved. The projecting edge should be at least 2 ins. from any other object and at least 12 ins. above the ground.

In districts where termites are injurious, buildings should be inspected at least once a year, and if infestation is found, control measures should be instituted while it is still localised. These comprise the removal of all wood débris from the soil round the foundations or beneath the building, structural alterations to conform with the recommended building specifications, the installation of termite shields, and where colonies are present in the soil, the use of soil poisons. In preliminary tests, sodium arsenite, coal-tar creosote, pentachlorphenol and orthodichlorobenzene gave protection for at least five years when properly applied. A 10 per cent. solution of sodium arsenite in water is effective in most situations, especially where leaching is unlikely to occur, at the rate of 1 U.S. gal. per 5 cu. ft. soil. It should not be used near wells or springs that serve as a source of drinking water. Creosote penetrates best when mixed with light fuel oil (1 : 3), the mixture being applied at the same rate as the sodium-arsenite solution. The odour usually disappears after two or three weeks indoors and after a few days in the open. Orthodichlorobenzene should not be applied near exposed sources of drinking water, since it may render the water unfit for use for a long time. It is more expensive than sodium arsenite or creosote and on a large scale is best used in a mixture with creosote and light fuel oil (1 : 1 : 6), which is applied at the rate of 1 U.S. gal. per 5 cu. ft. soil. On a small scale, it can be used with light fuel oil (1 : 3) at the same rate or alone at 1 U.S. gal. per 12 cu. ft. Pentachlorphenol is used as a 5 per cent. solution in fuel oil at 1 U.S. gal. per 5 cu. ft. Most oils will dissolve from 5 to 6 per cent. of crystalline pentachlorphenol at room temperatures, but kerosene and light naphthas dissolve only 3 per cent., and if the former is used, 5–10 per cent. of a more active solvent, such as pine oil, raw linseed oil or acetone, should be added. Instructions for treating new sites and infested soil round buildings and the precautions that should be taken in using these substances to ensure effective control and avoid risk are given.

FLETCHER (F. W.). **Fabric Pests. Tentative Fabric Pest Deterrent Tests as standardized by Joint Association Committee.**—*Soap* **18** no. 12 pp. 117, 119, 121, 123, 5 refs. New York, N.Y., 1942.

Much of the information in the first section of this paper, in which a method of testing the resistance of fabrics and yarns to insect pests is suggested, has been noticed from an earlier account [*cf. R.A.E.*, A **31** 165]. When experiments are carried out with other types of material, some specimens of untreated standard fabric should also be exposed to the test insects and others should be kept free from insects, as feeding and humidity controls, respectively. Specimens of fabric should have an area of 2 sq. ins., and yarns should be wound on a slide to give approximately the same area. *Attagenus piceus*, Ol., and *Tineola biselliella*, Humm., are recommended for testing as representative species of the two most common types of fabric pests, and both should be used in all tests, which should be carried out in the dark at a temperature of 78–82°F. and a relative humidity of 56–64 per cent. The resistance of the fabric to *A. piceus* is determined from the weight of frass and loss of weight of material after four weeks of feeding [*cf. loc. cit.*] and the resistance to *T. biselliella* by the loss of weight of material after two weeks of feeding. The specimens should be examined for visual evidence of damage and the percentage mortality of the test insects recorded, particularly if a stomach poison has been applied to the fabric.

In the second section, a tentative procedure for rearing and handling *A. piceus* is described. The most suitable type of culture medium is a mixture of fish meal, maize meal and powdered brewer's yeast (70 : 25 : 5) [*cf.* **31** 206], and a temperature of 75–85°F. and a relative humidity of 50–70 per cent. are recommended. A technique for maintaining cultures of the beetle so that

larvae of testing size and age are available at all times is described. The third section, which is by A. H. Goddin, contains similar information with regard to *T. biselliella*, which should be reared at the same temperature and humidity on a mixture of about ½ teaspoonful autoclaved dry brewer's yeast and 20 gm. woollen cloth. A fourth section, dealing with the evaluation of treatment designed to increase the resistance of fabrics to insect pests, is to be published later.

BLANCHARD (E. E.). **Un nuevo Exorístido, importante parásito del gorgojo de las hortalizas.** [A new Exoristid, an important Parasite of the Weevil, *Listroderes obliquus*.]—*Rev. Soc. ent. argent.* **11** no. 5 pp. 450–454, 5 figs. Buenos Aires, 1943.

Descriptions are given of the adults of both sexes of *Epiplagiops littoralis*, gen. et sp. n., from the Province of Santa Fe, Argentina, where it was found to be parasitising *Listroderes obliquus*, Gylh., to the extent of 52 per cent. Over 1,000 individuals of this Tachinid have been sent to the southern United States, where the weevil is a serious pest of vegetables.

BOSQ (J. M.). **Coccinélidos útiles para la fruticultura tucumana.** [Coccinellids beneficial to Fruit-growing in Tucumán.]—*Rev. Soc. ent. argent.* **11** no. 5 pp. 461–470, 17 refs. Buenos Aires, 1943.

This is a list based on personal observations of 27 predacious Coccinellids that occur in Tucumán, Argentina, or might be of use if introduced there, showing their distribution and the insects that they attack.

DE SEABRA (A. F.). **A entomologia do trigo.** [The Entomology of Wheat.]—*Arq. Secç. Biol. Mus. zool. Univ. Coimbra* **3** 699 + 13 + 4 pp., bibliography pp. 651–692. Coimbra, 1939. [Recd. 1943.]

This work is compiled from the world literature, and about half of it (pp. 7–352) consists of a survey of the insects that have been recorded as injurious to wheat in the field and in storage, with notes on their distribution, ecology and habits. This is followed by a section (pp. 353–438) containing systematic lists of the pests of growing wheat in Europe, Russia and Asia, Africa, America and Oceania (mostly Australia), showing the countries in which they occur, and notes on their relative importance, a similar list of insect pests of stored wheat and wheat products, and another of insects injurious to wheat in Portugal, with a discussion of their importance and the financial loss involved. The third part (pp. 439–557) is a survey of insects, mites, fungi, bacteria and Nematodes that are predacious or parasitic on wheat pests, and the fourth (pp. 559–592) contains lists of insects recorded as injurious to wheat by various authors throughout the world, arranged under countries. Myriapods, Arachnids, Nematodes, molluscs, birds and mammals that injure wheat are briefly reviewed in an appendix.

SCHWAN (B.). **Ärtvecklaren—ett svåråtkomligt skadedjur på ärter.** [*Cydia nigricana*—a Pea Pest that cannot easily be reached.]—*Växtskyddsnotiser* 1941 no. 3 pp. 41–43. Stockholm, 1941. [Recd. 1943.]

Cydia (*Laspeyresia*) *nigricana*, Steph., is a serious pest of peas in central Sweden, where it frequently causes about a third of the crop to be rejected, but is less injurious in the southern districts. Control is difficult, since the larvae are inaccessible once they have entered the pods. The eggs are laid on the flowers and young pods over a considerable period and hatch in about a week, and there is one generation a year, the full-fed larvae overwintering in cocoons in the soil. In experiments, early varieties were less attacked than late ones,

and the percentages of pods infested in plants that received 1, 2, 3 or 4 weekly applications, beginning when they were in full bloom, of a spray containing 0·2 per cent. nicotine and an adhesive, were 9, 8, 5·9 and 4·3, respectively, as compared with 12·2 in the controls.

AHLBERG (O.). **Årets jordloppshärjningar.** [Outbreaks of Flea-beetles in 1941.]—*Växtskyddsnotiser* 1941 no. 4 pp. 53–59. Stockholm, 1941. [Recd. 1943.]

TUNBLAD (B.) & AHLBERG (O.). **Bepudring mot jordlopporna.** [Dusting against Flea-beetles.]—*Op. cit.* 1942 no. 2 pp. 18–24, 6 figs. 1942.

In the first paper it is stated that, following a dry spring, injury by flea-beetles was unusually severe in Sweden in 1941. Barley and spring wheat, and to a less extent winter wheat and rye, were damaged by the overwintered adults of *Phyllotreta vittula*, Redt., which has become increasingly injurious to spring cereals in recent years. The Halticid larvae that occur low down in the straw in late summer are not those of *P. vittula*, as was previously thought, but *Crepidodera ferruginea*, Scop., which is not a serious pest in Sweden. The larvae of *P. vittula* live in the soil and feed on fine roots. Turnips and swedes were injured by *P. undulata*, Kutsch., and this species was more numerous than *Chaetocnema concinna*, Marsh., on beet. It is pointed out that dry weather in spring favours the activity of flea-beetles and may render the injury to the plants more serious, since they are less able to recover from it. The beetles are repelled by inert dusts, such as road dust, if the plants are well covered with them, and are also repelled and killed by arsenical dusts fortified with a contact poison such as pyrethrum. Work is now in progress in Sweden on the application of arsenical dusts combined with fertilisers.

It is stated in the second paper that the best treatment against flea-beetles is to dust with calcium arsenate at the rate of about 5·5–9 lb. per acre, and descriptions are given of several types of portable and wheeled dusting machines obtainable in Sweden that are suitable for applying it. A cloth bag on a pole carried by two men is also effective.

AHLBERG (O.). **Fortsatta besprutningsförsök mot plommonvecklaren.** [Further Experiments on the Control of *Cydia funebrana* on Plum.]—*Växtskyddsnotiser* 1941 no. 5 pp. 65–66. Stockholm, 1941. [Recd. 1943.]

As preliminary tests in Sweden in 1939 had shown that nicotine sprays were effective against *Cydia funebrana*, Treitschke, on plum, further experiments were carried out in 1940 and 1941 with a spray containing 0·2 per cent. nicotine. The trees were in flower at the end of May and the beginning of June in both years, but oviposition began a fortnight after the end of flowering in 1940 and a month after it in 1941, in which year it was completed in about 10 days (1st–11th July) and the eggs hatched in 3–4 days, instead of the usual 7–8. In 1940, the spray was applied on 21st and 26th June and 1st and 11th July, and the percentages of young fruits infested were 3–5 on trees treated once or twice and 1–2 on those treated 3 or 4 times, as compared with 13–14 on the controls. The third application was the most effective. The dates of spraying in 1941 were 26th and 30th June and 4th, 8th and 14th July, and the percentages of fruits infested at the end of August on trees sprayed on these dates were 13, 9, 8, 8 and 12, respectively, as compared with 15 on the unsprayed trees. It was only 5 on trees sprayed on the first four dates. Nicotine at half the concentration was ineffective, and it was found that the sprays were improved by the addition of soap or other suitable spreader.

NOTINI (G.). **Stinkflyn på lucern.** [Capsids on Lucerne.]—*Växtskyddsnotiser* 1941 no. 5 pp. 67–69, 1 fig. Stockholm, 1941. [Recd. 1943.]

Lucerne grown for seed in Sweden is injured by *Contarinia medicaginis*, Kieff., but a pest of greater importance in recent years has been the weevil, *Hypera* (*Phytonomus*) *nigrirostris*, F., which is active throughout the flowering period and prevents the setting of seed. In the summer of 1941, serious injury to second-year lucerne grown for seed in one locality was caused by the Capsids, *Adelphocoris lineolatus*, Goeze, which was the commoner, and *Calocoris norvegicus*, Gmel., both of which fed on the flowers and buds. Neither has previously been known as a pest of lucerne in Sweden.

MATHLEIN (R.). **Ett bekämpningsförsök mot kornmal.** [An Experiment on the Control of *Tinea secalella*.]—*Växtskyddsnotiser* 1941 no. 5 pp. 75–77. Stockholm, 1941. [Recd. 1943.]

Kornviveln. [*Calandra granaria*.]—*Flygbl. Växtskyddsanst.* no. 61, 4 pp., 3 figs. Stockholm, 1942.

In a further test of the effectiveness of pyrethrum powder against *Tinea secalella*, Zacher, on stored grain in Sweden [*cf. R.A.E.*, A **31** 282], described in the first paper, the treatment was applied in a granary containing wheat and smaller lots of rye and peas. On 5th June 1941, when a few moths were observed, the walls and floors and the surface of the heaps were dusted at the rate of 1 oz. per 300 sq. ft. and the dust was thoroughly mixed at the rate of 1 oz. to 250 lb. with about 220 lb. wheat, which was then placed in one of the heaps. Dusting was repeated on 18th and 25th June, when moths were numerous, and shortly after each application almost all the moths lay dead on the floor. A few that emerged between the applications paired and oviposited, and this is attributed to faulty coverage, due to air draught. The grain was turned several times during the summer, and samples were examined on 18th June, 13th July and 6th September. The wheat that had been mixed with the powder remained free from attack; many eggs had been laid on it, but the larvae had died soon after hatching and caused no injury. Some larval development had taken place in the dusted wheat, but much less than in previous years in this granary, when moths had been no more numerous, and injury was negligible. Little damage was caused to the rye, and very few of the grains were spun together; the peas were not attacked.

On the basis of this experiment, it is recommended that pyrethrum powder should be mixed with the stored grain in spring, before the moths emerge, at the rate at which it was tested and that the surface of the heaps should then be dusted at the rate of 1 oz. per 15 sq. ft. Dusting should be repeated after a few weeks and whenever the grain is turned, so that a protective layer is maintained throughout the oviposition period. The walls and floor and all wooden beams should be dusted at a lower rate. The powder can also be used to destroy the full-fed larvae that leave untreated grain in the late summer, and thus to reduce the overwintering population.

In the second paper, which comprises a brief account of the bionomics and control of *Calandra granaria*, L., in stored grain, it is stated that a similar treatment with pyrethrum powder gave good control of this weevil in recent experiments.

CASTBERG (C.). **Nya rön angående blodlusen.** [New Observations on *Eriosoma lanigerum*.]—*Växtskyddsnotiser* 1941 no. 6 pp. 86–90. Stockholm, 1941. [Recd. 1943.]

In spite of extreme cold in Sweden in the winter of 1940–41, young nymphs of *Eriosoma lanigerum*, Hsm., overwintering in cracks in the bark of apple trees

survived, though older individuals did not. Infestation has been found to be spread by the young nymphs, which migrate to the tips of the branches and are frequently borne away by the wind, and by the alate virginoparae that develop from the end of July to the end of September. Tests in the summer and autumn of 1941 showed that good control was given by a spray containing 15 per cent. denatured alcohol, 0·75–1 per cent. soft soap and 0·2 per cent. nicotine. *Aphelinus mali*, Hald., has been introduced into Sweden for the control of the Aphid, but though it is able to overwinter there and spread, it has not generally proved effective.

Nyponflugan. [The Rose Hip Fly.]—*Flygbl. Växtskyddsanst.* no. 57, 4 pp., 2 figs. Stockholm, 1941. [Recd. 1943.]

In view of the interest now taken in Sweden in the collection of rose hips, which are rich in vitamins, brief notes are given on the habits of *Rhagoletis* (*Zonosema*) *alternata*, Fall., which oviposits and completes its larval development in them. No method of control other than the collection and destruction of infested hips is known.

Ossiannilsson (F.). **Morotbladloppans vetenskapliga namn och utbredning i Sverige.** [The scientific Name of the Carrot Psyllid and its Distribution in Sweden.]—*Växtskyddsnotiser* 1942 no. 1 p. 11. Stockholm, 1942.

The Psyllid that infests carrots and causes serious injury to them in parts of Sweden has long been known as *Trioza viridula*, Zett., which was described from Lapland, but comparison has shown that it differs from the types of this species and should therefore be called *T. apicalis*, Först. Carrots are not grown in the northern part of Sweden, and *T. apicalis* has not been observed there further north than Västmanland.

Notini (G.). **Grönmykosen som bekämpningsmedel.** [Green Mycosis as a Means of Control.]—*Växtskyddsnotiser* 1942 no. 2 pp. 29–32, 2 figs. Stockholm, 1942.

In an experiment in May 1941, dill, radishes and lettuces in cold frames heavily infested by larvae of *Agrotis segetum*, Schiff., were dusted with an arsenical or pyrethrum powder or treated with a suspension of the spores of *Metarrhizium* [*anisopliae*]. The percentage mortalities after a few days were 23, 0 and about 80, respectively, and the numbers of larvae in the frames treated with the fungus were still very low a year later.

Mühlow (J.). **Bekämpning av rapsbaggar m. m. genom fångst.** [Control of Rape Beetles, etc., by trapping.]—*Växtskyddsnotiser* 1942 no. 3 pp. 33–37, 3 figs. Stockholm, 1942.

The authors gives brief notes on the habits of the rape beetle [*Meligethes aeneus*, F.] and the rape weevil [*Ceuthorrhynchus assimilis*, Payk.] which are serious pests of rape in Sweden. The former feeds in the flowers in both adult and larval stages, preventing the formation of seed, and the latter on the seeds in the larval stage and on the outside of the siliquae in the adult stage, thus facilitating oviposition by *Dasyneura brassicae*, Winn., and fungous infection. The best method of controlling both species is by means of mobile traps, and experiments with one similar to that of Buhl & Meyer [*R.A.E.*, A **25** 487; **27** 511] are described. It had six shallow trays and was attached to adjustable wheels and drawn by a horse. The horse disturbed a few adults, which escaped capture, but this was not sufficient to outweigh other advantages. It was found that the results could be improved by setting some of the trays back a little with respect to the transverse bar, and that a suitable liquid for use in

them was 5 per cent. tar distillate in water, or a mixture of 70 per cent. molasses, 25 per cent. water and 5 per cent. tar distillate, neither of which scorched the plants much if spilled. The molasses mixture is preferable as it does not spill so easily.

AHLBERG (O.). **Ökad skadegörelse av lövvedborren.** [Increased Injury by *Xyleborus dispar*.]—*Växtskyddsnotiser* 1942 no. 5 pp. 75–77, 2 figs. Stockholm, 1942.

The cold winters of 1939–40 and the two following years were followed by an outbreak of *Xyleborus* (*Anisandrus*) *dispar*, F., on fruit trees in Sweden, especially in south-eastern districts. Brief notes are given on the habits of this Scolytid, which attacks trees that have been weakened in any way and is therefore not a primary pest.

AHLBERG (O.). **Orienterande bekämpningsförsök mot lökflugan.** [A preliminary Experiment on the Control of the Onion Fly.]—*Växtskyddsnotiser* 1942 no. 5 pp. 72–74, 2 figs. Stockholm, 1942.

In the test described, which was carried out in 1942 near Stockholm, onion seed was moistened with a dilute starch paste and then mixed with an equal weight of mercurous chloride (calomel). Two months after sowing, the percentage of plants injured by *Hylemyia antiqua*, Mg., was 4·4 as compared with 27·5 in the controls. Watering the plants with various insecticides, including suspensions of arsenicals and emulsions of tar distillates, at low concentrations gave no control.

AHLBERG (O.). **Bekämpningsförsök mot kålflugor och morotfluga.** [Experiments on the Control of Cabbage Flies and the Carrot Fly.]—*Växtskyddsnotiser* 1942 no. 6 pp. 84–88. Stockholm, 1942.

An account is given of experiments in Sweden in 1942 in which a dust of crude naphthalene and one containing 4 per cent. mercurous chloride (calomel) were tested for the control of *Psila rosae*, L., on carrots and cabbage flies [*Hylemyia* spp.] on cabbages and cauliflower. Naphthalene was applied on 17th and 26th June and 7th July at rates of 5 and 10 gm. per plant to carrots that had been sown on 20th May, and the percentages of plants injured at harvest (late September) were 9 and 4·5, respectively, as compared with 31 in the control. The same treatments also gave good results on cabbage, and in one locality naphthalene at the lower rate reduced the percentage infestation from 80 in the controls to 25. The calomel dust was applied on 2nd and 17th July at the rate of 3 gm. per plant to carrots sown on 5th June and cauliflowers sown on 8th–10th June, and the percentages of plants infested at harvest were 35 and 39, as compared with 54 and 83, respectively, in the controls. An emulsion of 0·25 per cent. tar distillate showed some promise against both carrot and cabbage flies, but suspensions of arsenicals gave no reduction in infestation.

JOHANSSON (E.). **Om angrepp av jordloppslarver på stråsäd.** [Injury to Cereals by Flea-beetle Larvae.]—*Växtskyddsnotiser* 1942 no. 6 pp. 88–91, 2 figs. Stockholm, 1942. **Den egendomliga skadegörelsen på höstvetet 1942.** [The remarkable Injury to Winter Wheat in 1942.]—*Op. cit.* 1943 no. 1 pp. 1–10, 6 figs. 1943.

In the first of these papers the author states that wheat sown in the summer of 1942 ceased to grow in many parts of Sweden and the leaves turned yellow. The stems of many of the affected plants examined contained larvae of

Chaetocnema aridula, Gylh., and *C. hortensis*, Geoffr. (*aridella*, Payk.). Notes are given on the bionomics of these flea-beetles and also of *Crepidodera ferruginea*, Scop., which infests cereals and wild grasses but is of little importance.

The second paper contains a more detailed account of the injury and its distribution, and it is considered to have been caused by the feeding of insect larvae. In addition to the flea-beetles, the more important species identified were *Oscinella frit*, L., *O.* (*Conioscinella*) *nana*, Zett., *Elachiptera cornuta*, Fall., *Lasiosina cinctipes*, Mg., *Thaumatomyia notata*, Mg., *Opomyza florum*, F., and *Mayetiola destructor*, Say.

TUNBLAD (B.). **Nyare rön om karbolineumpreparat.** [Recent Experiments on Tar-distillate Preparations.]—*Växtskyddsnotiser* 1943 no. 1 pp. 11–13. Stockholm, 1943.

Two types of tar-distillate emulsions (fruit-tree carbolineums) are in use in Sweden as dormant sprays on fruit trees. The older type is emulsified with soap, while the later type, known in Sweden as spring carbolineum, has a much lower oil content, is emulsified mechanically with the aid of substances other than soap [*cf. R.A.E.*, A **29** 231] and is not so finely dispersed. It is in general less effective than the older type but causes less scorching. In view of the desirability of increasing its effectiveness, the author gives the results of experiments carried out at Vienna, in which the mortality of females of *Aspidiotus perniciosus*, Comst., sprayed with a spring carbolineum was greater at 10 than at 2°C. [50 and 35·6°F.] and was increased from 40 to 100 per cent. by the addition to the spray of 2·5 per cent. sodium hydroxide. Experiments in Switzerland have shown that spring carbolineum is less effective against insect eggs immediately before hatching than a month earlier.

MASSEE (A. M.). **The Hemiptera-Homoptera (Auchenorhyncha) associated with cultivated Fruits.**—*J. Soc. Brit. Ent.* **2** pt. 3 pp. 99–109, 19 refs. Parkstone, Dorset, 1941. [Recd. 1943.]

Brief notes are given on the relative importance, distribution and frequency of occurrence in southern England of 40 species of Jassids and Cercopids that feed on cultivated fruits, filberts [*Corylus avellana*] and hops. In addition to those noticed from a recent report [*R.A.E.*, A **30** 325], the more important are *Typhlocyba debilis*, Dgl., *T. quercus*, F., *T. rosae*, L., and *T. prunicola*, Edw., on plums, *T. rosae* on peaches, *T. prunicola* on currants, and *T. debilis* on figs.

LEFÈVRE (P. C.). **Etude économique des pyrèthrages.**—*Courr. agric. Afr.* 1942 no. 14 pp. 3–4. Léopoldville, 1942.

In an experiment in the Belgian Congo, 4 applications of a dust of pyrethrum powder and ash (1 : 4) reduced the loss of coffee berries due to infestation by *Antestia* [*R.A.E.*, A **30** 282] by 72·42 per cent., and figures are given showing that the treatment is economically profitable. It is also effective against other Rhynchota and Lepidoptera on coffee, lists of which are given.

HILL (G. F.). **Termites (Isoptera) from the Australian Region (including Australia, New Guinea and Islands south of the Equator between 140°E. Longitude and 170°W. Longitude).**—Med. 8vo, 479 pp. multigraph, 24 pls., 353 figs., 28 refs. Melbourne, Coun. sci. industr. Res. Aust., 1942.

In this systematic study, the author recognises four families, 14 genera, 11 subgenera, and 193 species from the region ; one subgenus and 32 species are new. Descriptions are given of the known castes of the various species, together with lists of their synonyms, data on their distribution and bionomics and brief notes on the damage caused by some of them. A list of all the species

indicating the castes of each that have been described in this or in other publications, a key to the genera based on characters of the soldiers, and the diagnostic characters of the families are included.

HELSON (G. A. H.). **Inert mineral Dusts as a Means of Control for Potato Moth,** *Phthorimaea operculella* **Zell., in stored Potatoes.**—*J. Coun. sci. industr. Res. Aust.* **15** no. 4 pp. 257–261, 1 fig., 4 refs. Melbourne, 1942.

Infestation of potatoes by *Gnorimoschema* (*Phthorimaea*) *operculella*, Zell., was severe in eastern Australia in 1941–42, and large populations occurred in plots of virus-free stock grown for seed at Canberra. Further attacks were expected on the stored tubers, and as it was thought that fumigation would interfere with later treatment to break the dormancy of the tubers [see next abstract] and derris dust was unprocurable in any quantity, some other treatment was required. Attention was accordingly directed to the inert dusts recently shown to be effective against weevils in stored grain [*R.A.E.*, A **29** 541].

Laboratory tests were carried out with magnesite (magnesium carbonate), lime and dolomite, ground to pass through a 200-mesh sieve and mixed with the tubers at a rate equivalent to 20 lb. per ton. When 17 females were placed in an oviposition jar containing four tubers, three eggs were deposited on the tuber treated with magnesite, four on the one treated with derris, five on the one treated with dolomite, and 27 on the untreated one. In preliminary experiments in which tubers were exposed to larvae for a few days, derris and magnesite afforded complete and practically complete protection, whereas dolomite did not ; many larvae were killed by contact with the derris dust. In an experiment in which batches of 60 tubers were treated with magnesite, derris, dolomite or lime, immersed for a few seconds in a proprietary emulsion of eucalyptus oil in water (1 : 30) or left untreated, and then subdivided into groups of ten, each of which was placed in a calico bag containing a heavily infested tuber and stored at a temperature of 26·7°C. [about 80°F.] for 36 days, the percentage infestation was only 1·7 and 5·0 among tubers treated with derris and magnesite, respectively, but exceeded 80 in all the others ; magnesite did not protect the sprouts that developed from the tubers after treatment. The amount of dust retained by the tubers was equivalent to 20 lb. per ton in the case of magnesite and derris, and much less in the case of lime and dolomite. When ten moths were confined with five untreated tubers or with five treated with derris, magnesite, dolomite or lime, the numbers of living larvae in each group of tubers after 20 days were 94, 0, 8, 36 and 43, respectively, in one experiment, and 47, 0, 5, 7, and 13 in another.

The relative humidity in a sack of tubers stored in the laboratory rose for three weeks until it reached an equilibrium between 60 and 70 per cent. and was not influenced by daily variations in the surrounding atmosphere ; towards mid-winter, however, when the atmospheric humidity increased, the humidity within the sack rose to 70 per cent. Experiments with treated tubers kept at 26·7°C. showed that magnesite retains its effectiveness at humidities of up to 80 per cent.

Large quantities of seed potatoes were best treated by rotating them in a drum after sprinkling the dust over them along the whole length of the drum. The treated tubers should be stored in a cool, dry, well-ventilated place, and if stored in sacks, the inside of these should also be dusted.

HELSON (G. A. H.). **Note on the Effect of the Acetylene Treatment of Potato Tubers on Potato Moth,** *Phthorimaea operculella* **Zell.**—*J. Coun. sci. industr. Res. Aust.* **15** no. 4 pp. 268–269. Melbourne, 1942.

In laboratory experiments to determine the effect on eggs and larvae of *Gnorimoschema* (*Phthorimaea*) *operculella*, Zell., of an acetylene treatment

recently developed for breaking the dormancy of seed potatoes, no mortality occurred among eggs that were immersed in a saturated solution of pure acetylene in water for 3 hours or in water alone for 4 hours, and only 4 per cent. among those immersed in the acetylene solution for 4 hours. When tubers containing larvae were immersed for ½, 1, 2 or 4 hours, however, percentage mortalities were 6·3, 19·4, 44·5 and 97·5, respectively, in the acetylene solution and 1·6, 5·4, 6·2 and 34·5 in water, the differences between solution and water being significant for immersion periods of 1, 2 and 4 hours. Treated tubers are readily re-infested. As prolonged immersion in water alone gave appreciable control, it is recommended for treatment of small numbers of tubers; they should be immersed for at least 24 hours.

Gay (F. J.) & Greaves (T.). **The Control of** *Pediculoides ventricosus* (**Newport**) **in Insect Cultures.**—*J. Coun. sci. industr. Res. Aust.* **15** no. 4 pp. 315–317, 3 refs. Melbourne, 1942.

Cultures of *Calandra oryzae*, L., and to a less extent of *C. granaria*, L., set up in Australia in June 1940 for experiment, were found two months later to be infested with the parasitic mite, *Pediculoides ventricosus*, Newp. The weevlis were reared in wheat in jars having metal screw-top lids with a hole 1½ ins. in diameter covered with 60-mesh gauze for ventilation. No control was given by dusting the weevils used for oviposition with sulphur, and dusting the wheat also was deleterious to the weevils and ineffective. The infestation was ultimately traced to two lots of cultures of *C. oryzae* seven and eight weeks old, from which it appeared that young mites were emerging and infesting the other jars. Fumigating the jars and the room with methyl salicylate [*cf. R.A.E.*, A **25** 330] was ineffective, and though banding the jars with tape soaked in a 6 per cent. solution of beta-naphthol in alcohol killed large numbers of mites, others crossed the bands over the bodies of the dead mites, and air-borne infestation continued. Control was finally obtained by banding the jars with strips of cloth soaked in a solution of 2 per cent. dinitro-ortho-cyclohexylphenol in a suitable petroleum oil. Within two months, no sign of mites could be detected in any of the cultures, and the method of application was then simplified by merely wiping the sides and lids of the jars with a cloth dipped in the solution as a routine precaution against fresh infestation.

Jacques (C.). **Maladie des goyaviers.**—*Rev. agric. Nouv.-Calédonie* 1942 pp. 4777–4781. Nouméa, 1942. **Insecte détruisant les goyaviers.**—*T.c.* p. 4859, 1 pl.

In the first of these notes, the author records that guava trees, which are a weed in New Caledonia, are attacked in the northern part of the colony by the Tineid, *Comodica decaspila*, Lower, of which the larvae mine vertically in the bark of the branches and trunk, causing the bast to dry up, and finally kill the tree. They pupate under the bark, and if the pupae are carefully removed, if possible with the bark, they can be placed on guava trees that it is desired to destroy. In the second note, it is pointed out that the pupae are found near ground level, and so would be killed by fires lit to clear the land.

Marlowe (R. H.). **A Laboratory Method for evaluating Feeding Preference of Fruitflies.**—*J. econ. Ent.* **35** no. 6 pp. 799–802. Menasha, Wis., 1942.

The author describes a technique for determining what sprays are most palatable to fruit-flies by exposing droplets of the sprays to be compared on a waxed card, and a method of analysing the data statistically, and gives the results of tests carried out with *Ceratitis capitata*, Wied., and *Dacus cucurbitae*, Coq. Both preferred invert sugar syrup, white maize syrup, laevulose, dextrose and sucrose to a solution of Hawaiian sugar-cane molasses at an equivalent

concentration ; the addition of acid lead arsenate to a spray containing invert sugar syrup or molasses or of tartar emetic to one containing invert sugar syrup did not affect their attractiveness. Adults of *D. cucurbitae* that were provided with solutions containing 1, 5, 8·5, 10, 12·5, 15, 20 and 25 lb. granulated sugar per 100 U.S. gals. of a 5 per cent. molasses solution showed an increase in preference as the concentration of sugar increased from 1 to 12·5 lb., but at concentrations higher than 12·5 lb., the increase in preference was not proportional to the increase in concentration.

KECK (C. B.). **Infestation of mature green Papayas by the Mediterranean Fruitfly.**—*J. econ. Ent.* **35** no. 6 pp. 802–805, 2 figs., 1 ref. Menasha, Wis., 1942.

Ceratitis capitata, Wied., readily attacks and develops in the ripe fruits of papaya in Hawaii, and 861, 304 and 652 pupae were reared from three ripe papayas weighing 1·5, 1·5 and 2 lb. that were exposed to approximately 300 flies for 24 hours. To determine the degree of infestation in papayas that are mature but unripe, at which stage they are harvested, samples were taken from the trees in a well-kept grove on Oahu at weekly intervals from the beginning of the fruiting period, or from the market, and kept for several days over sand, which was then sifted for puparia. The capture of only 15 flies throughout September 1938 in four traps showed that the fly population is low in papaya groves, presumably owing to the sparseness of the foliage, since 47 were caught in the week ending 21st September in one trap on an avocado tree on the border of the grove. Puparia were obtained from six of 23 samples of unripe papayas in various stages of maturity picked from the trees in 1938, three of the four collected at the stage for commercial picking being infested. The selection of fruits from the market was discontinued because of the chance of infestation after picking, but one infestation, observed in April 1936, was considered to be significant, since it was calculated that oviposition must have occurred before picking. From these results it is concluded that the shipment of untreated mature green papayas to the United States would result in the transport of immature stages of *C. capitata*. The author recommends that the trees should be planted at least 12 ft. apart and that ripening fruit should be removed from the grove to prevent the fly population from building up and to force flies to oviposit in the less mature fruits.

WEBSTER (R. L.) & O'NEILL (W. J.). **Time Relationship of Spring Brood Codling Moth Emergence, and subsequent Worm Entry.**—*J. econ. Ent.* **35** no. 6 pp. 806–809, 2 figs. Menasha, Wis., 1942.

Records of moth catches in bait pails have been used in the Pacific Northwest of the United States to determine suitable dates for applying early cover sprays for the control of the codling moth [*Cydia pomonella*, L.], on the assumption that peaks of moth abundance would ordinarily be followed within a few days by peaks of abundance of eggs. However, suitable temperatures are necessary for oviposition and the hatching of the eggs, and the abundance of moths in an orchard is not always shown by catches in traps, because of adverse climatic conditions. The custom of adding mineral oil to lead arsenate in the second or third cover spray makes it particularly desirable to know when eggs and young larvae may be expected. Comparison of moth abundance, as indicated by bait traps, and the numbers of larval entries, determined by removing and counting all apples showing entries on an unsprayed tree every two days in 1939–41, showed a minimum time interval between the earlier of the two peaks of moth abundance and the peak of larval entry of nine days in 1940, and a maximum interval of 29 days in 1939. The mean maximum temperatures for the two periods were 81·7 and 75°F. Mineral oil at ovicidal concentrations was of

great value in the second cover spray in 1940, when it was applied eight days before the peak of larval entry, but probably of little use in 1939 and 1941, when it was applied 14 and 19 days before, and had little value in the third cover spray in 1940 (four days after the peak of larval entry) but considerable value in 1939 and 1941 (nine and seven days before the first peak of larval entry and 18 and 14 days before the main peak, respectively). It is therefore suggested that, until better timing methods are available, either the second cover spray should be delayed until after the main peak of moth catch or mineral oil at ovicidal concentrations should be used in the second and third cover sprays.

SMITH (H. S.). **A Race of *Comperiella bifasciata* successfully parasitizes California Red Scale.**—*J. econ. Ent.* **35** no. 6 pp. 809–812, 6 refs. Menasha, Wis., 1942.

An account is given of attempts to introduce *Comperiella bifasciata*, How., into California for the control of *Aonidiella aurantii*, Mask., on *Citrus*, and the bearing of the difficulties that were encountered on biological control in general is discussed. The shipment of Coccids on *Citrus* was avoided because of the danger of introducing citrus canker. In 1916–17, large colonies of the parasite from a species of *Aonidiella* that occurred on *Podocarpus* in Japan and could not then be distinguished from the California scale were introduced into California, but though the parasite oviposited freely in *A. aurantii*, its progeny always died in the egg stage. In 1924–25, the parasite was again introduced from the Orient, parasitising *Chrysomphalus bifasciculatus*, Ferr., on *Aspidistra lurida*, and became established on *C. bifasciculatus* on *Aspidistra* in the open in southern California, but not on *Aonidiella* [*cf. R.A.E.*, A **15** 249]. As a result of these failures it was assumed that the race of *A. aurantii* in the Orient is physiologically different from that in California [*cf.* **18** 692; **25** 77]. In 1931, it was discovered that the parasite would develop on *A. citrina*, Coq., in California, and it was then successfully established in *Citrus* orchards infested by the latter. This suggested that the Japanese species of *Aonidiella* on *Podocarpus* might be *A. citrina*. In view of the possibility that the red scale on *Citrus* in China might be *A. aurantii*, in which case the *Comperiella* attacking it must be a race physiologically distinct from that in Japan, examples of *A. aurantii* from Californian *Citrus* orchards were taken to China on *Cycas revoluta* and exposed to attack by *Comperiella*, which, however, failed to reproduce in them. In 1937, it was found that *Habrolepis rouxi*, Comp., an African parasite of *A. aurantii* introduced into California in 1936 [*cf.* **25** 77], reproduced readily in the scale on *Citrus*, but was unable to do so on *Cycas revoluta*, and morphological characters distinguishing the various species of *Aonidiella*, found at about the same time, showed that the Japanese scale on *Podocarpus* was *A. taxus*, Leon. [**28** 264], and the Chinese scale on *Citrus* apparently *A. aurantii*. In view of these discoveries, it was considered possible that the Chinese race of *Comperiella* might have been successfully introduced if its hosts had been bred on *Citrus* instead of *Cycas*, and accordingly, in 1940, *Citrus* bearing parasitised red scale was sent from China to the Quarantine station in New Jersey, where the plants were tested for canker and the parasites reared. The adult parasites were sent by air to California, where they were found to develop normally in the Californian *A. aurantii*. Large numbers have since been propagated and liberated, and the race has apparently become established in *Citrus* orchards.

It is concluded that in biological control work, an accurate knowledge of the taxonomic relationships of the host insect, clarified if necessary by biological studies, is of great importance, and it must be recognised that the food-plant may confer a kind of immunity from parasitism on the host and that there are host-limited races of insect parasites.

QUAYLE (H. J.). **A physiological Difference in the two Races of Red Scale and its Relation to Tolerance to HCN.**—*J. econ. Ent.* **35** no. 6 pp. 813–816, 2 figs., 9 refs. Menasha, Wis., 1942.

The author points out that although it has been found that the spiracles of the resistant strain of *Aonidiella aurantii*, Mask., close within 3–5 minutes of exposure to hydrocyanic acid gas and remain closed for at least 30 minutes if the gas is still present, whereas those of the non-resistant strain close at the same time but open in about a minute [*cf. R.A.E.*, A **29** 535], this difference does not appear to be chiefly responsible for the difference in reaction of the two races to hydrocyanic acid gas. It does not appear to be correlated with the fact that the difference in tolerance to the gas in the two strains is marked in exposures of 2·5 minutes or less as well as at other exposures up to 2 hours and occurs independently of protective stupefaction or differences in temperature. Also, although resistant scales are most tolerant during the second moult, when it is possible that the spiracles may not be functioning, non-resistant scales are most tolerant just after the second moult.

YUST (H. R.), BUSBEY (R. L.) & NELSON (H. D.). **Reaction of resistant and nonresistant Strains of California Red Scale to Fumigation with HCN.**—*J. econ. Ent.* **35** no. 6 pp. 816–820, 9 refs. Menasha, Wis., 1942.

The following is based on the authors' summary. The effect of the temperature before, during and after treatment and of prefumigation with sublethal dosages on the susceptibility of resistant and non-resistant strains of *Aonidiella aurantii*, Mask., reared on lemon fruits in the laboratory at a constant temperature of 77°F. and a relative humidity of 65 per cent. to fumigation with hydrocyanic acid gas was studied under controlled conditions. When scales were preconditioned and postconditioned for four hours at the treatment temperatures, the kill of both races in the second moult and of resistant scales in the mature female stage was increased by lowering the temperature from 77 to 50 and 59°F., respectively, but the kill of non-resistant mature females was not influenced by the treatment temperature. When mature females were preconditioned for 18 hours instead of four, the kill of the resistant scales was increased and that of the non-resistant scales decreased by lowering the temperature from 77 to 59°F. In fumigations of scales in the second moult at both 59 and 77°F., preconditioning at 59° increased the kill of both strains, but the effect was produced more quickly in the non-resistant strain. In fumigations of mature females at 59°, short preconditioning periods of 2 or 4 hours significantly increased the kill of resistant scales but did not influence the kill of the non-resistant strain. There was no difference in the mortality of non-resistant scales in the second moult at postfumigation temperatures of 59 and 77°F., but that of resistant scales in the same stage was slightly greater at the lower temperature after pretreatment and treatment at 77° and at the higher one after pretreatment and treatment at 59°. In the second moult, the kills of both strains were decreased by prefumigation with sublethal dosages, but the differences were more marked with the resistant strain. In the mature female stage, the kill of resistant scales was decreased significantly by prefumigation in treatments at 59°F. The kill of the non-resistant scales was not changed by prefumigation one hour before the final fumigation when the preconditioning period was four hours, but significantly increased when it was 18 hours.

YUST (H. R.) & HOWARD (L. B.). **Factors influencing Results of Laboratory Fumigation of California Red Scale with HCN.**—*J. econ. Ent.* **35** no. 6 pp. 821–824, 4 refs. Menasha, Wis., 1942.

The following is based on the authors' summary. Laboratory fumigations were carried out to determine the cause of variations in the results of fumigation

with hydrocyanic acid gas against *Aonidiella aurantii*, Mask. The scales were reared on lemon fruits and fumigated at 77°F. and 65 per cent. relative humidity. Better kills were obtained on lemons that were slightly soft than on those that were firm and turgid. At times the kill on fruits from different groves was markedly different, although the appearance of the fruits was the same. On the same fruits, mature female scales that were fused together were a little more difficult to kill than those that were not touching. Difference in age within the stage frequently affected the kill, probably owing to a difference in degree of development [*cf. R.A.E.*, A **31** 192]. Raising the temperature from 77 to 95°F. after fumigation increased the mortality of scales in the second moult and of mature females, whereas lowering it to 52° tended to increase the mortality of scales in the second moult but to reduce that of mature females. The scales in the second moult developed more slowly after a high kill than after a low one, so that the total mortality could not be determined so quickly after a high kill.

Yust (H. R.), Nelson (H. D.) & Busbey (R. L.). **Fumigation of Yellow Scale with HCN under Laboratory Conditions.**—*J. econ. Ent.* **35** no. 6 pp. 825–826, 1 ref. Menasha, Wis., 1942.

The following is substantially the authors' summary. Yellow scales (*Aonidiella citrina*, Coq.) that were reared in the laboratory on lemon fruits were fumigated with hydrocyanic acid gas under controlled conditions. Mature females were considerably less susceptible to fumigation than those in the second moult, whereas under similar conditions, California red scales [*A. aurantii*, Mask.] were harder to kill in the second moult than as mature females. In the second moult, yellow scales and red scales of the non-resistant strain were about equally susceptible, but in the mature stage, yellow scales and red scales of the resistant strain were about equally susceptible. As in the case of the red scale, the mortality of the yellow scale decreased as the temperature at the time of fumigation was increased. Prefumigation with sublethal dosages caused in practically all cases a considerable lowering of the mortality of the yellow scale in both the mature and second-moult stages exposed immediately after to a lethal concentration. Yellow scales from stocks obtained in southern California were more difficult to kill than those from stocks obtained in central California.

Lindgren (D. L.) & Dickson (R. C.). **Spray-fumigation Experiments on California Red Scale.**—*J. econ. Ent.* **35** no. 6 pp. 827–829, 4 refs. Menasha, Wis., 1942.

The results of laboratory experiments in which mature females of *Aonidiella aurantii*, Mask., 38–40 days old, on grapefruit were fumigated for 40 minutes at a temperature of 75°F. with hydrocyanic acid gas at the rate of 0·11 mg. per litre for non-resistant scales and 0·4 mg. per litre for resistant ones, sprayed with light-medium emulsive spray oil at a concentration of 0·5–1·5 per cent., or given both treatments with an interval between of 1–14 days, during which the fruits were kept at 70–73°F., indicated that scales that survive treatment with oil have the same susceptibility to fumigation as untreated scales and that the length of the interval between treatments is not important. In similar experiments with scales 5, 8, 13, 16, 21, 30 and 38 days old, early grey adults (21 days old) and earlier stages were very susceptible to the oil spray and late grey adults and adults (30 and 38 days old) relatively resistant, whereas the last two were susceptible and the second moult and early grey stages resistant to fumigation.

It appears, therefore, that the satisfactory control of *A. aurantii* by treatment with oil sprays and fumigation is due to the additive effect of the treatments and

to the complementary nature of the kills resulting from them. The order in which the treatments are given has no significant effect on the combined results, but the factors of climate and tree tolerance indicate that the spray should usually precede fumigation in the field [*cf. R.A.E.*, A **23** 108 etc.].

FLANDERS (S. E.). **Biological Observations on the Citricola Scale and its Parasites.**—*J. econ. Ent.* **35** no. 6 pp. 830–833, 14 refs. Menasha, Wis., 1942.

Coccus pseudomagnoliarum, Kuw., is a pest of *Citrus* in the dry inland section of California, but except for an area in the San Francisco Bay region it is seldom found on the coast. The other plants on which it has been recorded in California [*R.A.E.*, A **5** 409] are attacked only when growing near infested *Citrus*. An introduced species of hackberry, *Celtis sinensis*, was very heavily infested in California, but is apparently not attacked in China or Japan. Other hackberries that serve as food-plants are *C. australis*, *C. occidentalis* and the native species, *C. reticulata*, which was infested in some districts within 20 miles of infestations on *Citrus* in 1930–36 but almost free from infestation by 1942. There is normally one generation in the year; oviposition begins towards the end of April, and the eggs hatch in 2–3 days. The young develop slowly until early in the following spring, after which development is rapid. The scale migrates from the leaves to the twigs in autumn or winter on deciduous food-plants and in March or early April on *Citrus*. In 1932, the progeny of scale from hackberry completed a life-cycle in two months at a constant temperature of 85°F. on potted *Citrus* or hackberry; the scales on hackberry were normal but those on *Citrus* had less than the usual number of antennal segments.

The scale apparently does not occur in Australia; in Japan, its favoured food-plant is *Poncirus trifoliata* and it is found only in small numbers on *Citrus*. It is parasitised by *Metaphycus orientalis*, Comp., *Coccophagus yoshidae*, Nakay., *C. japonicus*, Comp., *C. hawaiiensis*, Timb., and *Anicetus annulatus*, Timb., in Japan, and by *M. stanleyi*, Comp., *M. helvolus*, Comp., *M. luteolus*, Timb., *C. lycimnia*, Wlk., and *C. scutellaris*, Dalm., in California. In 1933, *Aneristus ceroplastae*, How., introduced from Hawaii, was observed to complete its development in this scale, but was not liberated against it, and in April 1936, *C. caridei*, Brèth. (*heteropneusticus*, Comp.) introduced from South America, was colonised on *Citrus* trees infested with it and reproduced readily, but did not become established, probably because the adult parasites could not survive the period of host unsuitability.

FLANDERS (S. E.). **Abortive Development in parasitic Hymenoptera, induced by the Food-plant of the Insect Host.**—*J. econ. Ent.* **35** no. 6 pp. 834–835, 11 refs. Menasha, Wis., 1942.

Recent investigations have indicated that marked physiological differences, manifested by the developmental reactions of a parasite, may exist between individuals of a single host species feeding on different plants. The parasite may be able to complete its development in one case but unable to do so in another, the extent of successful parasitism being probably determined by the quality or proportion of chemical constituents of the food digested by the host. Examples of this are shown by the Encyrtids, *Habrolepis rouxi*, Comp., and *Comperiella bifasciata*, How. (Chinese race), which develop successfully in *Aonidiella aurantii*, Mask., on *Citrus* but not on *Cycas revoluta* [*cf. R.A.E.*, A **31** 328], apparently owing to the inability of the scale to ingest a normal proportion of nutritive substances, since the parasites die in all stages of development, and the Braconid, *Apanteles congregatus*, Say, which reproduces in *Protoparce sexta*, Joh., and *P. quinquemaculata*, Haw., on burley tobacco or tomato in the United States, but not on dark-fired tobacco, possibly owing to

its greater nicotine content [*cf.* **27** 253]. *Cycas revoluta*, when serving as the food-plant of *Aonidiella citrina*, Coq., does not prevent the complete development of either Chalcidoid, and the ectoparasitic Aphelinid, *Aphytis chrysomphali*, Merc., can complete its development on *A. aurantii* on this plant, though it suffers a comparatively high mortality in its immature stages.

DOHANIAN (S. M.). **Parasites of the Filbert Worm.**—*J. econ. Ent.* **35** no. 6 pp. 836–841, 5 refs. Menasha, Wis., 1942.

Notes are given on the distribution, life-history and economic importance of 13 species of parasites bred from *Cydia* (*Melissopus*) *latiferreana*, Wlsm., collected from various food-plants [*cf. R.A.E.*, A **29** 405; **31** 107] in Washington, Oregon and western California in 1938–41. With the exception of *Macrocentrus ancylivorus*, Rohw., which confined its activity almost completely to acorns, the common parasites attacked the host in a wide range of food-plants; *Ephialtes* (*Calliephialtes*) *nucicola*, Cushm., was reared from larvae infesting filberts (*Corylus avellana*), hazelnuts (*C. americana* and *C. cornuta*), acorns, Catalina cherries (*Prunus lyonii*) and galls on the branches, twigs and leaves of oak (*Quercus garryana*), and *Lissonota inconstans*, Cushm., from larvae in all these except the galls and also in walnuts. Other parasites comprised an undescribed species of *Orgilus* from acorns, *Microdus* (*Bassus*) *nucicola*, Mues., *Phanerotoma tibialis*, Hald., and a species of *Angitia* from acorns and galls on oak, an undescribed species of *Perisierola* from oak galls, *Glypta rufiscutellaris*, Cress., from hazelnuts, *Elachertus evetriae*, Gir., from filberts, *Anachaetopsis tortricis*, Coq., from filberts and acorns, *Aenoplex carpocapsae*, Cushm., from a cocoon in the soil, and *Trichogramma minutum*, Ril., from the eggs. In addition, *M.* (*B.*) *laticinctus*, Cress., *Perisierola gracilicornis*, Kieff., and another species of *Perisierola*, bred from hazelnuts, *Phorocera erecta*, Coq., from filberts and species of *Goniozus* and *Plectops* from oak galls were probably parasitic on *C. latiferreana*.

STRUBLE (G. R.). **Laboratory Propagation of two Predators of the Mountain Pine Beetle.**—*J. econ. Ent.* **35** no. 6 pp. 841–844, 1 fig., 6 refs. Menasha, Wis., 1942.

From the results of investigations on the feasibility of artificial rearing of predators for liberation against *Dendroctonus monticolae*, Hopk., in sugar pine [*Pinus lambertiana*] during outbreaks in the western United States [*cf. R.A.E.*, A **31** 135], the author draws the following conclusions. It was found that *Temnochila virescens*, F., and *Enoclerus sphegeus*, F., could be reared under artificial conditions from egg to adult in the laboratory. The methods used were highly successful for *T. virescens*, but *E. sphegeus* failed to become adapted to an artificial environment. The use of a suitable substitute host that can be reared cheaply in large numbers is desirable for the production of large quantities of these predators in the laboratory, as the cost of rearing them on their native prey is much too high for practical purposes, and the use of the logs necessary to rear the prey is too cumbersome and is wasteful of green timber. Although larvae of *Lucilia sericata*, Mg., showed considerable promise as food for larvae of *Temnochila* that had passed the first instar, it was not satisfactory for the younger stage. Modifications of procedure, possibly by using larvae of another fly, such as *Drosophila*, with a softer integument, may be possible.

The benefits to be derived by rearing large numbers of these predators are too uncertain to justify high rearing costs, and unless methods can be developed that will overcome these objections, there is little hope of increasing their beneficial effect except by protecting them in nature.

Smith (H. S.) & De Bach (P.). **The Measurement of the Effect of entomophagous Insects on Population Densities of their Hosts.**—*J. econ. Ent.* **35** no. 6 pp. 845–849, 2 figs., 2 refs. Menasha, Wis., 1942.

The authors discuss the difficulty of obtaining statistical evidence of results from the establishment of insect enemies of insect pests. They suggest that, until more satisfactory quantitative methods of population analysis are developed, entomologists claiming success from biological control should submit field estimates showing that the establishment of the entomophagous species was followed, in each limited area and within a reasonable period of time, by an appreciable reduction in the host population and that after its general establishment, the host population remained at a much lower level, on the average, than before, and detailed or more exact data showing decidedly higher survival of the host when protected from attack by the entomophagous species than when exposed to it. They point out the need for a technique for measuring the effect of the entomophagous species on the population density of its host and describe an experimental one in which *Saissetia oleae*, Bern., on *Citrus* in California was subjected to attack by the parasite, *Metaphycus helvolus*, Comp., or protected from it by means of organdie sleeves [*cf. R.A.E.*, A **31** 90], and discuss the limitations of the method.

Furniss (R. L.). **Biology of *Cylindrocopturus furnissi* Buchanan on Douglas-fir.**—*J. econ. Ent.* **35** no. 6 pp. 853–859, 1 fig., 4 refs. Menasha, Wis., 1942.

An account is given of the biology of *Cylindrocopturus furnissi*, Buchanan [*cf. R.A.E.*, A **29** 370]; its only known food-plant is *Pseudotsuga taxifolia*, but it has, until recently, been confused under the name *C. longulus*, Lec., with a number of closely related species that live principally in pines. Observations made in 1935–41 at La Grande, Washington, in a naturally established stand of 20-year-old trees that has been rather heavily infested for a number of years were supplemented by records from other places in western Washington, Oregon and north-western California. The weevil is widely distributed, but causes relatively little damage except on individual plantations. It sometimes kills trees less than 5 ft. high and does not appreciably injure those more than 15 ft. high, but deformation and stunting may occur on certain types of soil, and injury may increase to a considerable extent after drought.

In Washington, there is one complete generation in the year and possibly a partial second, and the sexes occur in about equal numbers. Larvae of all sizes, adults and possibly eggs overwinter. Pupae are present in cells in the bark, wood and pith between late April and late July, and adults begin to form by 20th May and emerge between mid-June and early August. They feed on the inner bark of the small branches, throughout their active life, and most of them cling to the branches during winter. Eggs are laid in the living bark from the beginning of August to the beginning of October, after a preoviposition period of about a month, and practically all hatch before winter; some of the surviving adults resume oviposition in spring, but the spring brood seems to be relatively unimporant. The larvae bore down to the wood, where they extend their galleries along the branch and later round it. A fungus, *Pullularia pullulans*, was closely associated with this weevil and may help it to overcome the resistance of the trees. Factors that were observed to give natural control were the production of excess pitch by the attacked trees, which killed many eggs and very small larvae, competition for suitable food and living space, and parasitism. The larvae were parasitised by *Euderus argyresthiae*, Crwf., *Eupelmella vesicularis*, Retz., *Eurytoma tomici*, Ashm., *Ephialtes* (*Calliephialtes*) *comstocki*, Cress., a species of *Amblymerus* resembling *A. verditer*, Nort., *Cecidostiba dendroctoni*, Ashm., *Rhopalicus pulchripennis*, Crwf., and undetermined

species of *Tetrastichus* and *Caenacis*, and the adults by an undescribed species of *Microctonus*. *Dendrosoter scaber*, Mues., *Microbracon pini*, Mues., and *Urosigalphus pini*, Cushm., were reared from branches infested with *Cylindrocopturus*, which was assumed to be the host. Artificial control is considered unnecessary under forest conditions, but may be desirable in plantations ; no practical measures have been developed.

STONE (M. W.). **Dichloroethyl Ether for Control of the Sugar-beet Wireworm.**—*J. econ. Ent.* **35** no. 6 pp. 860–866, 4 refs. Menasha, Wis., 1942.

An account is given of experiments carried out in California in 1937–39 on the use of β-β dichloroethyl ether as a soil insecticide for the control of *Pheletes* (*Limonius*) *californicus*, Mannh. [*cf. R.A.E.*, A **25** 436]. In preliminary experiments in 1937, solutions containing 0·2, 0·4, 0·8 and 1·2 fl. oz. dichloroethyl ether per 100 U.S. gals. water, applied on 7th April at the rate of 4–6 U.S. gals. per 100 ft. to rows of maize and wheat sown as baits on 30th March and showing an average of six wireworms per foot of row, killed 81–100 per cent. of the larvae, whether applied at about an inch above the planting depth or on the soil surface, and apparently did not repel them. To determine the effect of applying the insecticide directly to irrigation water, dichloroethyl ether, emulsified with 1·4 oz. sodium salt of an alkyl ester of sulphosuccinic acid per U.S. gal. was added to tap water at the rate of 3, 4, 5 and 7 fl. oz. per 100 U.S. gals. and run into shallow trenches (7 ins. deep by 10 ins. wide) containing caged wireworms at depths of 1 and 6 ins. from the bottom and distances of 25, 50, 75, 100, 125 and 150 ft. from the point of application, at the rate of about 1 U.S. gal. per ft. Mortalities of 48–88 per cent. were obtained with 3 fl. oz. per 100 U.S. gals. and of 83–100 per cent. with 4, 5 and 7 fl. oz., as compared with 5 per cent. in control cages, which were flooded with water only. Wheat in the cages germinated and appeared to be unaffected by the insecticide. High rates of mortality to a depth of 8 ins. were also obtained by treating seed potatoes and germinating maize planted in furrows with concentrations of 3–7 and 2·6–6·1 fl. oz. per 100 U.S. gals. water, applied at rates of 1–1·4 and 1–3 U.S. gals. per ft., respectively, and the plants suffered no injury or retardation in growth. Newly set tomato plants that were artificially infested with three wireworms each and treated with solutions of 7, 10, 14 or 17 fl. oz. dichloroethyl ether in 100 U.S. gals. water at rates of 1 or ½ U.S. gal. per plant showed no living wireworms after one week for the three higher concentrations applied at 1 U.S. gal. per plant, and very few for the other applications, as compared with plants treated with water only. The root systems were less well developed than those of the latter one and two weeks after treatment, but there was no appreciable difference between plants treated with the two lower concentrations and with water after eight weeks, though most of those treated with the higher concentrations were stunted or killed. Since examination of many injured tomato plants showed that practically all wireworms entered 4–5 ins. below the surface of the ground, it appeared unnecessary to apply large quantities of solution to penetrate below the root system, and the same concentrations were therefore applied at the rate of 1 U.S. pint and 1 U.S. quart per plant to newly set plants artificially infested with 10 wireworms each. There was a decided reduction in wireworm population and a high mortality, particularly among those treated with the higher concentrations ; the effect on the root systems was the same as before. The application at the time of planting seed potatoes of a mixture of 20 lb. of a fertiliser (ammonium sulphate), 2 lb. yellow pine sawdust and 13·5 fl. oz. dichloroethyl ether to 420 ft. of row at a distance of about 2 ins. on each side of the potatoes and a depth of 4 ins. resulted in only 4 living wireworms in 90 seed pieces dug 7–17 days after treatment, as compared with 99 in 90 untreated pieces, the number of living and dead larvae per sq. ft. soil being 1·8 and 1·1 in treated rows and 8·8 and none in untreated ones. Irrigation water containing

1·38 fl. oz. insecticide per 100 U.S. gals., applied at the rate of 2·6 U.S. gals. per sq. ft. to the surface of the soil to determine whether the control given by flooding [*cf.* **25** 175] would be accelerated by the addition of dichloroethyl ether, reduced the population by 87 per cent. at a depth of 1–8 ins. but only 44 per cent. at 8–12 ins., where 53 per cent. of the wireworms were. Less effective results were obtained when the solution was applied in furrows at the rate of 0·8 U.S. gal. per sq. ft. soil surface.

Dichloroethyl ether did not injure sugar-beets or set onions when a concentration of 3·4 fl. oz. per 100 U.S. gals. was applied at about 1 U.S. gal. per foot of row, or cabbages when concentrations of 20–30 fl. oz. per 100 U.S. gals. were applied at the rate of 1 U.S. gal. per plant.

Fulton (R. A.) & Howard (N. F.). **Effect of the Addition of Sulfonated Oil on the Toxicity of Cube and Derris to Plant Bugs.**—*J. econ. Ent.* **35** no. 6 pp. 867–870, 1 fig., 1 ref. Menasha, Wis., 1942.

The results are given of laboratory tests to determine the relative effect of natural vegetable-oil emulsions and sulphonated vegetable oils in increasing the effectiveness of derris sprays against *Anasa tristis*, DeG., and of cubé sprays against *Murgantia histrionica*, Hahn [*cf. R.A.E.*, A **26** 739] and also the effect of adding acetone to the cubé. The acetone was added to the cubé powder before the oil and an hour before the spray was prepared ; the oils were added in time for the powders to become soaked with them. Adults of *M. histrionica*, reared in the laboratory, were treated with sprays containing enough derris powder (3·5 per cent. rotenone, 18·2 per cent. total extractives) to give 0·01 per cent. rotenone alone or with 0·5 per cent. sulphonated oil or natural oil emulsified with sodium lauryl sulphate (2 gm. per U.S. gal.), and adults of *A. tristis*, collected in the field, with sprays containing enough cubé powder (4·1 per cent. rotenone, 12·6 per cent. total extractives) to give 0·0062 per cent. rotenone and 1 per cent. sulphonated or emulsified natural oil, with or without the addition of 1 per cent. acetone. The sulphonated oils were equal or superior to the corresponding natural oils in effectiveness and are preferable because they are miscible or emulsible with water. The derris gave 7 per cent. mortality of *Murgantia* in 72 hours when used alone, as compared with from 23 to 92 per cent. with the different oils. Soy-bean, coconut, castor and linseed oils were much more effective when sulphonated, maize oil was rather more effective, and olive, teaseed and cottonseed oils gave approximately equal mortalities in the two states ; the outstanding sprays contained natural or sulphonated olive oil (90 and 92 per cent. mortality) or sulphonated soy-bean oil (87 per cent.). In the cubé sprays against *A. tristis*, ground-nut and grapefruit seed oils were equally effective whether sulphonated or not, but soy-bean oil was much more effective when sulphonated. The addition of acetone increased the toxicity considerably in every case, ground-nut oil with acetone (94 and 96 per cent. mortality) and sulphonated soy-bean oil with acetone (91 per cent.) being most effective. Field tests in which cubé sprays in combination with 1 per cent. natural or sulphonated ground-nut, soy-bean or grapefruit seed oil were applied to four varieties of squash, melon, cucumber, cabbage, collard and kale showed that some injury may result from the application of oil, but that sulphonated oils are less injurious than emulsified natural oils.

Arant (F. S.). **Effectiveness of Derris and Cube in Pickleworm Control.**—*J. econ. Ent.* **35** no. 6 pp. 870–872, 2 refs. Menasha, Wis., 1942.

As it has been shown that dusts of derris and talc containing 1 per cent. rotenone control *Diaphania nitidalis*, Stoll, under favourable conditions in Alabama [*cf. R.A.E.*, A **29** 404 ; **30** 256], further experiments were carried out in 1941 to determine the effectiveness of dusting cantaloupe melons with

derris at different intervals and the relative efficiency of derris and cubé against this Pyralid on cantaloupes and cucumbers. A mixture of derris, talc and flour (5 : 14 : 1) containing 1 per cent. rotenone was applied at intervals of 5, 10 and 15 days from 23rd June, when the first fruits were set, any applications that were washed off by rain within 24 hours being repeated until the dust had remained on the plants for a total of 24 hours. Frequent showers reduced the effectiveness of dusting and stimulated the development of the fungus, *Macrosporium cucumerinum*, which caused considerable damage to the cantaloupes. The amount of dust applied was increased from 12·5 to 15 and then to 17·5 lb. per acre, the average rate per application being approximately 14 lb. Dusting at intervals of 10 and 15 days gave only about 24 and 11 per cent. control, but 11 applications at 5-day intervals gave 61 per cent.

This dust and dusts of cubé, talc and flour (4 : 15 : 1) and derris, talc, flour and Cuprocide (25 : 64 : 5 : 6), each containing 1 per cent. rotenone, were applied 12 times to cantaloupes planted on 9th June at five-day intervals from 27th July, when the tips of most runners had been killed by larvae of *D. nitidalis*; the rate of application was successively increased from 12·5 to 15, 17·5 and 20 lb. per acre. Injury was extremely heavy in all plots during the first three weeks of the dusting period, owing to migration of moths from earlier melons, and appreciable control was not obtained until the rate of dusting was increased to 20 lb. per acre. The treatment did not give practical control, though 750–2,080 uninfested melons per acre matured on the dusted plots and none on the control plots. Derris was more effective than cubé, and healthier plants and higher yields were obtained on plots treated with the Cuprocide dust. The derris dust without Cuprocide and the cubé dusts, applied to cucumbers at the rate of 12·5 lb. per acre 10 times at 5-day intervals from 9th June, when the fruit began to set, reduced the average percentage of fruits infested to 2·86 and 8·79, respectively, as compared with 42·57 on untreated plants. Infestation was light during June, but very heavy towards the end of July.

ARANT (F. S.). **Relative Effectiveness of several Rotenone-containing Insecticides against various Insects.**—*J. econ. Ent.* **35** no. 6 pp. 873–878, 16 refs. Menasha, Wis., 1942.

The following is based on the author's summary. Commercial samples of derris, timbo and cubé and samples of powdered *Tephrosia* roots from the U.S. Bureau of Plant Industry were tested in the laboratory and field on several species of insects. Chemical studies were also made by the Goodhue method to determine the relation of the rotenone-deguelin value to rotenone content and insecticidal efficiency. Derris and *Tephrosia* were more effective than *Lonchocarpus* (cubé or timbo) of the same guaranteed rotenone content against the following insects: *Ceratomia catalpae*, Boisd., *Epilachna varivestis*, Muls., *Rhopalosiphum pseudobrassicae*, Davis, *Brevicoryne brassicae*, L., *Leptinotarsa decemlineata*, Say, *Murgantia histrionica*, Hahn, *Diaphania nitidalis*, Stoll, *D. hyalinata*, L., *Chrysochus auratus*, F., *Evergestis rimosalis*, Gn., and mixed caterpillars from cabbage in the field. The different insecticides appeared moderately and equally effective against nymphs of *Anasa tristis*, DeG., and all were ineffective against *Nezara viridula*, L., *Anticarsia gemmatalis*, Hb., *Feltia annexa*, Treitschke, and *Apantesis phyllira*, Dru.

The median lethal doses of the various insecticides to last-instar larvae of *Ceratomia catalpae* were expressed as milligrams of a 1 per cent. rotenone powder as follows: derris, 0·07; *Tephrosia*, 0·07; timbo, 0·11; cubé, 0·17. Expressed as milligrams of principal toxins (rotenone-deguelin value), the doses were 0·0016, 0·0015, 0·0018 and 0·0019, respectively. In nearly every experiment, an insecticide with a high rotenone-deguelin value was more effective against a susceptible insect than one with a lower value, whereas in many experiments, one insecticide was more effective than another of approximately

the same rotenone content. Each of four commercial samples of derris and one of *Tephrosia* were higher in rotenone-deguelin value than any of eight samples of *Lonchocarpus* of the same guaranteed rotenone content. Timbo usually had a higher value than cubé in the samples studied, but exceptions were noted. These data indicate the inadequacy of rotenone content alone to express the insecticidal value of a rotenone-bearing product and emphasize the importance of the Goodhue rotenone-deguelin value as a supplementary expression.

Hill (R. E.) & Tate (H. D.). **Life History and Habits of the Potato Flea Beetle in western Nebraska.**—*J. econ. Ent.* **35** no. 6 pp. 879–884, 4 figs., 6 refs. Menasha, Wis., 1942.

The following is based on the authors' summary and conclusions. In the potato-growing section of western Nebraska, it was found that a relatively high percentage of adults of *Epitrix cucumeris*, Harr., survived the winter of 1940–41 in soil covered with débris or crop residue such as potato plants, and smaller but significant numbers in bare soil in a potato field from which the crop residue had been removed, as well as in lucerne stubble and uncultivated areas. Survival ranged from 8·3 per cent. in lucerne stubble to 34·5 per cent. in soil covered with potato plants. In the insectary in 1941, two complete generations developed during the season [*cf. R.A.E.*, A **27** 342, etc.]. Emergence from hibernation continued from about 20th May until early July, though the majority of adults had emerged by about 20th June. Oviposition by overwintered females took place from 26th May until 22nd August in the insectary rearing tests, but the peak occurred soon after mid-June, so that most of the eggs were deposited before the late potato crop was growing. Eggs of the second generation were deposited between 13th July and 3rd October, with the peak near mid-August. These results were confirmed by field observations.

From the data obtained, it seems evident that the first generation develops largely in early-planted potatoes and the second generation principally in the late plantings, and that the elimination of the early potato crop, including plantings up to about 10th June (a relatively small proportion of the total acreage in western Nebraska), would materially reduce the likelihood of serious injury by *E. cucumeris* in this area. Intensive collections and observations indicate that wild food-plants are of comparatively little significance in the development of heavy populations in western Nebraska; early planted potatoes are growing well when the overwintered beetles emerge, and these plants supply an abundance of food.

Sorenson (C. J.). **Insecticidal Tests for Field Control of *Lygus* Bugs in Seed Alfalfa.**—*J. econ. Ent.* **35** no. 6 pp. 884–886. Menasha, Wis., 1942.

Preliminary tests in 1933 against *Lygus elisus*, Van D., and *L. hesperus*, Knight, which seriously limit the production of lucerne seed in Utah, showed that economic control, as shown by comparative seed yields, was not obtained by dusting sulphur at 10, 15 or 25 lb. per acre, calcium cyanide dust (40 per cent.) at 20 or 40 lb. per acre, or 4, 6 or 8 per cent. nicotine sulphate dust, all applied twice at an interval of two weeks when the lucerne was in bud or in flower. In 1937–39, further tests were carried out with twelve dusts containing different insecticides or combinations of them, applied weekly from the prebud stage until some seed pods were mature, at the rate of 10, 20 or 40 lb. per acre. Of those tested, pyrethrum dust (0·1 per cent. pyrethrins) in pyrophyllite (5 : 95 or 10 : 90) was most effective in killing caged nymphs and adults and in reducing their numbers in the open field, though the populations usually began to increase again 4–5 days after treatment. Dusting sulphur resulted in 6·25 and 9·38 per cent. mortality of caged adults and nymphs three hours after treatment, the inclusion of

5 per cent. Paris green or 25 per cent. calcium arsenate caused an insignificant increase in mortality, and sulphur dust, alone or in combination, sometimes caused severe scorching of lucerne flowers in dry weather.

In 1940–41, only the pyrethrum dusts were tested. They were applied at the rate of 15 and 30 lb. per acre at intervals of 2 and 6 days in 1940 and of 2, 4 and 6 days in 1941. Statistical analysis indicated that the 10 per cent. dust gave insignificantly higher seed yields than the 5 per cent. dust and the dosage of 30 lb. per acre insignificantly higher yields than 15 lb. per acre; and that application at intervals of two and four days produced highly significant increases in yield, whereas treatment at intervals of six days gave yields that were insignificantly better than those from untreated plots.

From the results obtained it was concluded that lucerne is one of the favourite food-plants of *Lygus* spp. in Utah; that none of the materials tested can be recommended, since although the population may be significantly reduced by the application of insecticides, reinfestation takes place within 4–5 days owing to the wide range of food-plants and strong flight of the adults, and the bugs possess an unusually high degree of natural resistance to most of the common insecticides; and that weekly applications of insecticides with wheeled dusting machines do considerable damage to growing seed lucerne.

Smith (C. F.). **The Use of Cyanide in controlling the Root Form of the Woolly Apple Aphid.**—*J. econ. Ent.* **35** no. 6 pp. 908–910, 5 refs. Menasha, Wis., 1942.

Further tests on the use of sodium cyanide in slightly alkaline water for the control of the woolly apple aphis [*Eriosoma lanigerum*, Hsm.] on the roots of apple trees 1–2 years old in North Carolina confirmed the results of earlier ones [*cf. R.A.E.*, A **30** 266]. Good control was obtained with 0·1 gm. cyanide per tree in 1 U.S. pint water in 1940 but not in 1941, and with 0·5 gm. in 1 U.S. pint in both years. It is considered that less water and cyanide are needed in moist situations than in dry ones where the infestation extends over all the roots; enough water and cyanide should be used to enable the latter to reach the lowest Aphids on the roots. Trees were injured by treatment with more than 1 gm. cyanide or with 1 gm. in less than 1 U.S. quart water. In general, the injury was heavier in 1941 than in 1940, as the heavy infestation that had developed by 1941 had weakened the trees, and control was less successful in 1941, because the Aphids were near the surface of the soil in 1940, but had infested practically the entire root system by 1941, when many were 8–10 ins. below the surface. When applied at the rate of 2 U.S. pints per tree and at concentrations of 1 : 800 and 1 : 1,600, carbon-bisulphide emulsion was ineffective, but dichloroethyl-ether solution gave good control in 1941 with some injury to the trees.

Aphid-free apple seedlings approximately 18 inches high were not injured by sodium cyanide at dosages of 1 gm. or less in 1 U.S. pint water per tree, or by carbon bisulphide at 1 : 1,600, but were susceptible to dichloroethyl ether at the concentrations used and to 2 gm. sodium cyanide in 1–4 U.S. pints water. A list of materials that gave poor control or injured the plants is appended.

Graham (L. T.) & Richardson (C. H.). **Spreaders in Codling Moth Sprays.**—*J. econ. Ent.* **35** no. 6 pp. 911–914, 41 refs. Menasha, Wis., 1942.

The authors describe investigations made in Iowa in 1940 to determine whether spreader-adhesives increased the efficacy of lead arsenate in the control of the codling moth [*Cydia pomonella*, L.] on apple [*cf. R.A.E.*, A **29** 406]. The addition of 4 oz. soy-bean flour or 8 oz. lime-casein (calcium caseinate) to eight cover sprays of 3 lb. lead arsenate and 3 lb. hydrated lime per 100 U.S. gals. water did not improve the control of *C. pomonella*. The addition of 2 fl. oz. of a proprietary spreader-adhesive, consisting of sodium oleyl sulphate and a synthetic resinous adhesive, appeared to reduce the percentage of infested fruit

and the number of larvae per 100 apples, but the differences were not significant. It is concluded that more uniform distributions of spray materials may not necessarily result in improved control, and that improvement of the physical properties of a spray mixture is not always correlated with improved insecticidal effect.

HANSBERRY (R.). **Toxicity of Nicotine Compounds to newly hatched Codling Moth Larvae.**—*J. econ. Ent.* **35** no. 6 pp. 915–918, 4 refs. Menasha, Wis., 1942.

The following is substantially the author's summary. Laboratory tests of 31 compounds of nicotine to newly hatched larvae of the codling moth [*Cydia pomonella*, L.] were made with both fresh and artificially weathered deposits on apples. Water-soluble compounds, with the exception of nicotine sulphate, gave poor kills both before and after weathering. Most insoluble compounds gave high kills with fresh deposits, but the coarser crystalline materials lost much of their effectiveness during weathering. Fine powders that were water-resistant lost comparatively less toxicity during weathering. Since these materials were used without supplements, many of them may be improved by fine grinding, controlled precipitation, or the use of supplements.

Fixed nicotines were always more toxic than soluble materials, indicating that nicotine compounds kill newly hatched larvae primarily by stomach poison action, since it has been shown previously that fixed compounds are not toxic as contact agents. The best material, nicotine cuprocyanide, permitted only 8 per cent. entries in fruit sprayed with 0·5 lb. per 100 U.S. gals. and artificially weathered with 1 inch of rain, as compared with 44 per cent. entries in fruit sprayed with 3 lb. lead arsenate per 100 U.S. gals. and weathered under the same conditions.

LIVINGSTONE (E. M.) & SWANK (G. R.). **Fumigation of small Land Areas for Control of White-fringed Beetles.**—*J. econ. Ent.* **35** no. 6 pp. 919–922, 3 figs. Menasha, Wis., 1942.

Experiments were carried out in Alabama and Mississippi during 1939–41 to determine whether methyl bromide or carbon bisulphide could be used to fumigate small areas such as heeling-in grounds, plunging beds and hot beds in nurseries for the control of *Pantomorus leucoloma*, Boh., and *P. peregrinus*, Buchanan, so that the soil taken from them on plants would be eligible for movement under Federal and State quarantine regulations to places where the insects are unknown. Liquid methyl bromide was injected 6–9 ins. into the soil under pressure at the rate of 1 injection per 1½ sq. ft., and liquid carbon bisulphide was poured into conical holes in the soil (1 per sq. ft.), about 6 ins. deep and 1 inch in diameter at the top, and covered immediately with a handful of soil ; the surface of the treated areas was covered with builders' waterproof felt paper. Preliminary tests having shown that 4·7 cc. methyl bromide and 33 cc. carbon bisulphide per sq. ft. were the minimum practical dosages, these were tested at various exposures and under naturally fluctuating temperatures in soil that was naturally infested or artificially infested with caged insects in all stages of development at depths of 6, 12, 18 and 24 ins. below the surface. It was found that methyl bromide would give complete mortality of all stages of the insects with an exposure of 3¾ days when the soil temperature was 62–89°F. and with an exposure of 6 days when it was 45–62°. Carbon bisulphide gave complete mortality with a 3–4 day exposure at a temperature of 80–87°F. At lower temperatures consistent mortality was not obtained with any of the exposures tested, though the pupae and adults were killed in all tests.

FARRAR (M. D.) & REED (R. H.). **Insect Survival in drying Grain.**—*J. econ. Ent.* **35** no. 6 pp. 923–928, 1 fig. Menasha, Wis., 1942.

Details are given of the results of tests made in view of the possibility that the recently developed equipment for drying hybrid seed maize by passing heated air through it could be used to control insects breeding in the grain. Laboratory experiments, planned to include a series of time, temperature and humidity relations that would kill all the insects, were carried out with maize on the ear in which *Sitotroga cerealella*, Ol., *Calandra* (*Sitophilus*) *oryzae*, L., and *C.* (*S.*) *granaria*, L., were breeding and wheat containing the two weevils, *Rhizopertha dominica*, F., *Laemophloeus* sp., and *Tribolium confusum*, Duv. Lethal drying conditions were determined for all the insects ; it was found that in each case mortality increased as the temperature, humidity or length of drying period increased. The two species of *Calandra* were killed at lower temperatures, lower humidities and shorter exposures than the other insects. *Tribolium* and *Laemophloeus* were less resistant to drying than *Sitotroga*, and *Rhizopertha* was the most resistant. Drying tests with bulk grain showed that the insects were more easily killed in maize on the ear than in shelled maize, wheat or barley, because the large air spaces permitted rapid movement of the air. The tendency for air to seek channels through a mass of grain or ears may result in differences of as much as 50°F. in the temperature within a distance of 2–4 inches.

It is concluded that the commercial drying of hybrid seed maize at dry bulb temperatures of 105–110°F. and wet bulb temperatures of 70–80°F. would not kill the common insects that infest stored grain.

WILBUR (D. A.), BRYSON (H. R.) & PAINTER (R. H.). **A major Outbreak of the Southwestern Corn Borer in Kansas.**—*J. econ. Ent.* **35** no. 6 pp. 938–399. Menasha, Wis., 1942.

Numerous reports of infestation of maize by *Diatraea grandiosella*, Dyar, in south-western Kansas in 1941 indicate that this moth, which is a native of Mexico but is extending its range to the north and east in the United States and reached Kansas in 1931 [*cf. R.A.E.*, A **22** 318], is present in at least 29 counties ; incomplete autumn surveys in 1942 revealed infestation in 18 additional counties, including two maize-growing counties on the Nebraska border. Throughout the region, infestation was heaviest in the light, sandy soils in which most of the maize is grown. In young maize attacked by the first generation, injury to the upper leaves and the curl was most prominent ; in late-planted maize, dwarfed and misshapen plants were abundant, many ears and shanks were bored, and mature larvae of the overwintering generation usually girdled the interior of the stalks, 5–12 ins. above the surface of the soil, as a result of which these broke or bent over. Brief notes are given on the life-history of the borer [*cf. loc. cit.*]. Counts made about the end of March 1942 showed that 66 per cent. of the overwintering larvae, which are usually in the base of the stalk, had died in undisturbed stalks, 76 per cent. in those that were thrown to the surface (by tillage with a lister or oneway or by pulling and placing horizontally) and 81 per cent. in stalks buried horizontally, 2 and 6 ins. deep. Where soil conditions permit, throwing out infested stalks and stubble by means of a oneway or lister is recommended as a method of control Although early planted maize was often heavily infested, it appeared to be sufficiently mature when it was attacked to withstand borer feeding without severe injury ; late-planted maize was more severely injured and was also attacked by the second generation, and planting as early as is consistent with sound agronomic practice is therefore suggested. Since only maize was severely damaged, infestation in sorghum reaching 54 per cent. in self-sown plants, but not more than 4 per cent. in planted fields, maize should be replaced by sorghum where this is practicable.

JANES (M. J.). **Cube and Nicotine in the Control of** *Phyllotreta vittata discedens* **Weise.**—*J. econ. Ent.* **35** no. 6 pp. 939–940, 1 ref. Menasha, Wis., 1942.

As cubé dusts had given excellent control of adults of *Phyllotreta vittata discedens*, Weise, in Texas in 1938–40 [*cf. R.A.E.*, A **30** 255], it was compared with a spray of cubé and a nicotine dust against this flea-beetle on mustard in the same locality in 1941 and 1942. In the first year, four applications were made in May and June of dusts containing cubé powder in dusting sulphur (0·5 per cent. rotenone) and a proprietary concentrated nicotine dust in dusting gypsum (1·5 per cent. nicotine), at the rate of 25 lb. per acre in the first application and 30 lb. per acre in the others, and of a spray of cubé powder in water (0·025 per cent. rotenone), at the rate of 100 U.S. gals. per acre in the first applications and 112 U.S. gals. per acre in the later ones. All the treatments resulted in significantly less injury, as determined by the number of holes per sq. in. leaf surface at maturity, than occurred in the untreated plots; there was no significant difference between the cubé dust and spray, but both were significantly better than the nicotine dust. In 1942, when a proprietary pyrophyllite was used as a carrier in both dusts and the concentration of nicotine was increased to 3 per cent., four applications in June and July of 30 lb. dust per acre or 100 U.S. gals. spray per acre reduced the injury significantly and showed no significant difference between treatments.

HARRIS (H. M.) & BRINDLEY (J. M.). **The European Corn Borer in Iowa.**—*J. econ. Ent.* **35** no. 6 pp. 940–941. Menasha, Wis., 1942.

In view of the large areas of maize grown in the State, the marked increase in the range of *Pyrausta nubilalis*, Hb., in Illinois and Wisconsin, and the favourable conditions for its increase in 1942, maize fields in eastern Iowa were surveyed for the presence of the borer from 10th August. It was found in small numbers the first fortnight, which was apparently between the two annual generations, infested plants were numerous towards the end of August and during the first week in September, and on 19th September 10 per cent. of the stalks were infested in a field that showed no infested plants on 21st August, indicating a marked increase in extent and degree of infestation in the second generation. A list of 19 counties in which infestations were found is given; counties to the west of these were surveyed, but no borers were found.

GUNTHER (F. A.) & TURRELL (F. M.). **A preliminary Report of a critical Examination of the Roots of** *Derris elliptica*.—*J. econ. Ent.* **35** no. 6 p. 941, 4 refs. Menasha, Wis., 1942.

In this summary of some of the results obtained in a study of the histology and chemical constituents of derris roots, carried out with air-dried derris root and confirmed by identical experiments on fresh roots of *Derris elliptica*, the authors discuss the location of the cells that contain rotenone, starch and tannin, respectively, and the nature of the resin bodies, sugars and other reducing substances and saponin-like substances present. They consider that since rotenone is found in discrete water-insoluble particles in the plant cells and is dispersed in water to a very low concentration when derris root is macerated, the effectiveness of derris roots as fish poisons may be due not to the rotenone content alone, but to accompanying substances, such as saponins, and that further investigations should be made on such materials in species of *Derris*.

KNOWLTON (G. F.), FRONK (W. D.) & MADDOCK (D. R.). **Seasonal Insect Food of the Brown-shouldered Uta (Lizard).**—*J. econ. Ent.* **35** no. 6 p. 942. Menasha, Wis., 1942.

The authors record the recognisable insect food contained in the stomachs of 2,798 examples of *Uta stansburiana*, collected on semi-desert breeding areas of

the beet leafhopper, *Eutettix tenellus*, Baker, or near its food-plants in Utah in 1932–41 [*cf. R.A.E.*, A **23** 33]. Lizards taken each month from March to October were found to contain the leafhopper, over 14,000 of which were present in 52·3 per cent. of those examined. The numbers of insects of 15 Orders found in lizards collected in March–June, July–August and September–October are given in a table; they comprised over 28,000 individuals. Many stomachs contained unidentified insect fragments, but relatively few contained plant fragments.

Bibby (F. F.). **Some Parasites of *Heliothis armigera* (Hbn.) in Texas.**—*J. econ. Ent.* **35** no. 6 pp. 943–944, 5 refs. Menasha, Wis., 1942.

Records are given of some parasites bred from *Heliothis armigera*, Hb., or observed attacking it in Texas, with notes on the dates of emergence of the parasites and the food-plants of the host in some cases. Those that emerged from pupae comprised the Tachinids, *Archytas piliventris*, Wulp, *Achaetoneura archippivora*, Will., and *Blondelia* (*Anetia*) *armigera*, Coq.; those reared from larvae were the Tachinid, *Achaetoneura frenchii*, Will., the Sarcophagids, *Sarcophaga latisterna*, Parker, *S. rapax*, Wlk., and *Hypopelta scrofa*, Aldr., the Braconids, *Microbracon mellitor*, Say, *Microplitis croceipes*, Cress., *Iphiaulax* (*Monogonogastra*) *rugator*, Say, and *Zele melleus*, Cress., the Eulophid, *Euplectrus comstocki*, How., and the Ichneumonids, *Neopristomerus appalachianus* var. *dorsocastaneus*, Vier., and *Sagaritis provancheri*, D. T.; and those from eggs were the Scelionid, *Telenomus heliothidis*, Ashm., and the Trichogrammatid, *Trichogramma minutum*, Ril. Adults of the Bethylid, *Perisierola cellularis*, Say, and an undetermined species of *Belyta* were observed attacking larvae. The Sarcophagids were considered to be parasitic and not acting as scavengers, although the host of *Sarcophaga latisterna* was not found until it was dead.

Kenaga (E. E.) & Fletcher (F. W.). **Effects of high Temperature on several Household and Storage Grain Pests.**—*J. econ. Ent.* **35** no. 6 p. 944. Menasha, Wis., 1942.

The authors show in a table the effect of raising the temperature of the laboratory from 80 to 105°F. for 64 hours, during which time the relative humidity dropped from about 55 to 40 per cent., on 17 species of household, stored-product and other laboratory test insects. *Oryzaephilus surinamensis*, L., *Calandra* (*Sitophilus*) *oryzae*, L., and *Ephestia kuehniella*, Zell., were the only ones of which all stages were killed.

Dahms (R. G.). **Rice Stinkbug as a Pest of Sorghums.**—*J. econ. Ent.* **35** no. 6 pp. 945–946, 2 refs. Menasha, Wis., 1942.

During 1941, after a mild winter and an unusually wet spring, adults of the Pentatomid, *Solubea pugnax*, F., caused serious injury to some varieties of sorghum at Lawton, Oklahoma. They were first observed feeding on 7th August and were very abundant until about 23rd August, when they began to leave the sorghums in large numbers, so that by 1st September, very few could be found. It was not determined where they came from or went to; Johnson grass [*Sorghum halepense*] and several native grasses, examined in September, were not infested. Varieties of sorghum that were in flower during the attack were most damaged, many heads becoming sterile and others containing shrivelled and shrunken grain. In general, late-maturing varieties were most seriously injured, but there also appeared to be some difference due to variety, both in attractiveness and in resistance, and yields of 49·6, 20·3 and 7·4 bushels per acre were obtained on three plots of the same variety that ripened on 13th and 18th August and 5th September, the low yield in the latest plot being almost entirely due to injury by *Solubea*.

To determine the number of bugs necessary to destroy a sorghum head, various numbers from five to a hundred were caged on heads for 30 days ; five per head caused some injury, and 25 or more prevented the production of normal seeds.

RAINWATER (C. F.). **Armyworm Habit of** *Heliothis armigera* **(Hbn.).**—*J. econ. Ent.* **35** no. 6 pp. 946–947, 1 ref. Menasha, Wis., 1942.

In 1932, larvae of *Heliothis armigera*, Hb., became very abundant in vetch fields on three farms in South Carolina and, during the last week in May they migrated in thousands into neighbouring fields in the manner of armyworms. They caused severe damage to cotton, maize, soy beans, velvet beans, sweet potatoes, tobacco and weeds in the line of march and also attacked sugar-cane and ripening wheat, rye and oats. The vetch was not sufficiently defoliated to make movement in search of food necessary, but enormous numbers of larvae had developed, as a result of which they came into direct contact with one another, which apparently stimulated movement, and many parasitic flies were present. The feeding and movement of the larvae were apparently confined to the day-time, beginning at about 10 a.m.

Furrows ploughed round the fields, with post holes at intervals of 4–6 ft., trapped practically all the marching larvae. A moistened bait of 6 lb. wheat middlings, 4 oz. sodium arsenite and 1 U.S. pint molasses, spread in and near the furrows and applied on the leaves and in the buds of maize, was very effective, and dusting cotton and maize with calcium arsenate resulted in complete mortality within 24 hours. The infestation practically disappeared in about two weeks after it became noticeable, probably largely owing to parasitism.

DONOHOE (H. C.) & GADDIS (C. H.). **Methyl Bromide Fumigation of Refrigerator Trucks.**—*J. econ. Ent.* **35** no. 6 p. 947, 2 refs. Menasha, Wis., 1942.

One of the chief means of obtaining certification of produce for transport by railway under the regulations of the quarantine against the Japanese beetle [*Popillia japonica*, Newm.] in the United States is fumigation of loaded refrigerator cars with methyl bromide [*cf. R.A.E.*, A **28** 610 ; **29** 124, etc.]. Owing to increased interest shown in 1941 in the possibility of applying the same treatment to produce loaded in refrigerators trucks for transport by road, eight trial fumigations were carried out with dosages of 1·5 or 2 lb. methyl bromide per 1,000 cu. ft. for 2 hours. All the trucks have sound bodies and are equipped with circulating fans that enter the front wall and have sufficient power to prevent initial stratification of the fumigant. In the first test, in which the fumigant was directed upwards from a spray nozzle about 8 ins. from the floor rack, and the temperature ranged from 90 to 97°F., the fan was not operated, and the percentage mortality of caged beetles was 98·8 near the floor, but only 43·1 near the top of the empty truck. In the others, in which the fumigant was introduced through a top hatch by a spray nozzle directed upwards, and the fan was run during its introduction and for five minutes afterwards, complete mortality of beetles at all levels and within bags of onions or hampers of beans or flowers was obtained at temperatures of 74–86°F. The lower dosage was used at temperatures of 80° or more and the higher one at lower temperatures.

NICKELS (C. B.). **Two economic Species of Mites on Pecan.**—*J. econ. Ent.* **35** no. 6 p. 948, 2 figs., 2 refs. Menasha, Wis., 1942.

Eriophyes caryae, Keifer, which causes rolling of the leaflets of pecan, many of which drop prematurely, and may injure half the leaflets on some trees, was observed on scattered pecan trees in six orchards in Texas and Louisiana during 1936–37, and *Paratetranychus viridis*, Banks, which occasionally causes important injury to the leaves, was found on scattered trees in many pecan orchards in

Texas. Frequently, both species were on the same leaflet. Weeds and ornamental plants were found near the trees severely infested by *P. viridis*, and no important mite infestation was found in pecan orchards in which clean cultivation was practised.

MARSHALL (J.). **The Term "Inverted Spray Mixture."**—*J. econ. Ent.* **35** no. 6 pp. 948–949, 4 refs. Menasha, Wis., 1942.

In answer to H. Knight [*cf. R.A.E.*, A **31** 99] and others who consider the name inverted spray mixture unsuitable for certain sprays developed for the control of the codling moth [*Cydia pomonella*, L.] in the Pacific Northwest [*cf.* **26** 174, etc.], the author points out that in these sprays the position of the solid particles with reference to the liquid components of the system is reversed or inverted, the finely divided lead arsenate or cryolite that was initially wetted by water becoming wetted by oil, either in the spray tank, at the moment of leaving the aperture of the spray gun, or at the moment of impact on the sprayed surface. A mixture may be in such condition that although appearing stable in the spray tank, it forms a curd and adheres tenaciously after passage through the release valve of the spray pump or through a spray gun, being so changed physically that it cannot be passed through the spray machine again without re-emulsification.

POTTS (S. F.), CLINE (A. C.) & MCINTYRE (H. L.). **The White Pine Weevil and its Control by the Application of concentrated Sprays.**—*J. For.* **40** no. 5 pp. 405–410, 4 figs., 2 refs. Washington, D.C., 1942.

Pissodes strobi, Peck, the larvae of which kill the terminal shoots of white pine [*Pinus strobus*] by feeding in the cambium, thus deforming the trees, is one of the most injurious forest insects in the north-eastern United States, and has recently damaged commercial plantings. White pines growing naturally under conditions of partial suppression in mixed stands are not attacked and produce high-quality timber, and this method of protection has been adapted for use in pure stands, but it involves the destruction of the strongest trees and increased risk of fire. Experiments were therefore carried out in 1937–40 and are described in detail, in which a concentrated spray of lead arsenate, applied to the terminal shoots in spring to kill the ovipositing females, effectively protected trees in plantations 8–13 years old [*R.A.E.*, A **30** 590]. An average reduction of 96 per cent. in the numbers of trees attacked was obtained by the treatment, and there was also apparently a high mortality of new adults that fed on the poisoned shoots in summer and autumn. The trees should be protected from the age of about 6 years, when they become susceptible to attack, until the bole is so far developed that further protection becomes uneconomic. Reinfestation in a treated plantation is relatively slow, however, so that the spray need not be applied every year.

SALMAN (K. A.) & BONGBERG (J. W.). **Logging High-risk Trees to control Insects in the Pine Stands of northeastern California.**—*J. For.* **40** no. 7 pp. 533–539, 6 refs. Washington, D.C., 1942.

Since injury by bark-beetles to virgin stands of ponderosa pine [*Pinus ponderosa*] in north-eastern California cannot economically be controlled by direct methods, which are expensive and only temporary in their effect, indirect methods are to be preferred. These include the removal of mature and overmature trees, but existing methods of selecting the trees to be removed are unsatisfactory from the point of view of insect control, since they involve the elimination of a relatively high percentage of the trees and cannot be applied to large areas within short periods of time. The methods suggested by Keen

[*R.A.E.*, A **25** 416] do not permit sufficient mobility and rapidity of operation, and criteria were therefore sought that would permit the rapid removal of a smaller percentage of trees and reduce losses due to insects. As a result, four risk classes were established, based on the health of individual trees as indicated by the condition and amount of the foliage, the condition of twigs and branches and the presence of infestations causing top-killing or localised thinning or weakening of the upper part of the crown. The results of rating trees on this basis differed markedly from those obtained with silvicultural criteria.

During 1936–39, the susceptibility of 18,056 trees was determined according to these ratings. The trees in the two highest risk classes constituted 11·1 per cent. of the number in the stand and 15·5 per cent. of the board-foot volume ; and it was found in 1940 that the rate of loss among trees classified in 1936 was 30 times as great in these two classes as in the two low-risk classes. Experiments to determine the control given by light sanitation cuts based on these ratings were made on four different portions of an area of 1,563 acres, a different one of which was treated each year from 1937 to 1940, inclusive. The average reductions in loss one, two and three years after the treatment were estimated at 90·6, 82·0 and 71·9 per cent. respectively, and it is probable that the estimated reduction in loss over a period of three years is lower than the averages that will be obtained when the results from the cuts made in other years become available. During the same period, losses in virgin forest were increasing. Over 84 per cent. of the total volume of loss sustained during the investigations occurred among trees in the two highest risk classes ; insects were responsible for 9·32 per cent. of the losses among high-risk and only 0·31 per cent. of those among low-risk trees.

KEEN (F. P.) & SALMAN (K. A.). **Progress in Pine Beetle Control through Tree Selection.**—*J. For.* **40** no. 11 pp. 854–858, 10 refs. Washington, D.C., 1942.

The authors discuss the method of controlling *Dendroctonus brevicomis*, Lec., and associated insects that cause serious losses of ponderosa pine [*Pinus ponderosa*] in California, Oregon, Washington and Idaho by means of a light sanitation salvage cut [*cf.* preceding abstract] and review investigations by other workers that led up to it. Direct control methods include felling, barking and destroying infested trees, which is effective, but economically impracticable except during severe outbreaks and in stands of high value ; solar-heat treatments designed to kill bark-beetles, but not the predacious larvae of *Thanasimus nigriventris*, Lec. (*lecontei*, Wolc.), which are only partly effective and suited chiefly to summer control work under special conditions ; and spraying the bark of felled infested trees with oil [*R.A.E.*, A **26** 394], which is not suited for general application. Studies to determine the underlying causes of outbreaks have shown that over-mature, decadent trees making radial growth of less than 1 mm. per year are most susceptible to attack by *D. brevicomis*, particularly when growing on poor sites, that such trees may be attractive because of their poor physical condition as shown by slow growth, lack of response to environmental stimuli, or the production of certain sugars in the phloem [**21** 96], and that previous infestations may increase attractiveness by reason of the accompanying phloem fermentation. Infestation by *D. brevicomis* is usually preceded by top-killing due to *Ips oregoni*, Eichh., and *Melanophila californica*, Van Dyke. Buprestid larvae are often present in the cambium long before the tree is attacked by bark-beetles.

The two chief classifications of trees established for assessing the susceptibility of ponderosa pines so that the most susceptible trees may be felled and used before they are destroyed or their value deteriorates as a result of insect or fungous attack are compared. That of Keen, based on age and crown vigour

[**25** 416], gives a general indication of the types of tree in a virgin stand in which the highest losses may be expected to occur over a period of years, but does not indicate which individual trees are likely to be destroyed within a short period ; it is designed for long-term protection by means of lighter cuts than are generally practised, and provides a means by which risk of mortality due to insect attack may be taken into consideration when planning the management of stands. The classification of Salman & Bongberg, based on the symptoms of individual trees [*cf.* preceding abstract], provides for the assessment of trees likely to become infested during the current year in an attempt to reduce losses by the use of an extremely light cut over a large area as a sanitation measure preceding long-term silvicultural practices. The complete salvage each year of all trees showing actual or potential infestation is desirable, but impracticable except on easily accessible sites. A light sanitation cut makes possible the utilisation of a high percentage of the potential loss and can be applied to a large area each year, but it is also limited by the accessibility of the stands.

In preliminary trials, reductions in losses resulting from control by tree selection and sanitation felling were greater than those usually obtained by the direct method of felling and burning infested trees ; the utilisation of timber that would otherwise be lost may offset the cost of treatment and even yield a profit. The method is limited to reasonably accessible stands of high value and is not suited to parks or inaccessible commercial forest.

Beal (J. A.). **Mortality of Reproduction defoliated by the Red-headed Pine Sawfly** (*Neodiprion lecontei* **Fitch**).—*J. For.* **40** no. 7 pp. 562–563, 2 refs. Washington, D.C., 1942.

Periodic outbreaks of *Neodiprion lecontei*, Fitch, sometimes cause considerable mortality of young pines in reforested areas in the eastern United States, particularly if they are defoliated before late summer. The effect of defoliation in late summer was studied in North Carolina in 1939, when a local outbreak occurred in young stands of shortleaf pine (*Pinus echinata*) and loblolly pine (*P. taeda*), and 1940. In October 1939, 200 small infested pines 1–5 ft. high were classified into two groups according to exposure to direct sunlight and into four classes according to the amount of defoliation. The larvae do not destroy the sheath at the base of each group of needles, so that foliage losses could be determined fairly accurately in October, when feeding had ceased. Survival counts of the trees were made in the following May and August ; less than 5 per cent. of the mortality occurred between these two examinations, and it was considered unlikely that there would be much further loss that could be attributed to injury in 1939.

The mortality percentages among shaded trees that had suffered 0–25, 26–50, 51–75 and 76–100 per cent. defoliation were 0, 33·3, 55 and 96·5, respectively, and the corresponding figures for unshaded trees were 0, 0, 0 and 84·2. No trees survived complete defoliation. Heavy mortality where only part of the foliage was destroyed is attributed to feeding on the outer bark and the phloem of the twigs. Many trees that survive partial defoliation are deformed and are unlikely to be of great commercial value. On some of the plots in which competition with deciduous trees was greatest, all the pines were destroyed. The height and species of the trees did not influence their survival capacity.

Observations made in autumn by J. R. Jester in plots for felling showed that of a total of 4,628 pines, defoliation due to the larvae reached 66 per cent. or more in 45 per cent. of the trees. Among unshaded trees, the number heavily attacked was only 23 per cent. of the total, whereas among those shaded by deciduous trees, 53 per cent. showed defoliation of 66 per cent. or more.

Johnston (H. R.) & Eaton (C. B.). **Tests with various Chemicals for the Control of White Grubs in Forest Nurseries of the Carolinas.**—*J. For.* **40** no. 9 pp. 712–721, 1 ref. Washington, D.C., 1942.

An account is given of experiments in South Carolina in 1935–37 on the effect of soil poisons and fumigants on larvae of *Lachnosterna* (*Phyllophaga*) spp., which are injurious in forest nurseries, and on seedlings of loblolly pine (*Pinus taeda*). The soil poisons were incorporated with or sprinkled over uninfested soil in pots in which seeds of *P. taeda* were later sown. The pots were sunk in soil and, 3½ months after germination, were artificially infested with eggs of *L.* (*P.*) *soror*, Davis, or *L.* (*P.*) *luctuosa*, Horn. Of the 15 poisons tested, only cuprous cyanide and sodium tetrachlorphenate were shown to afford any control of the larvae, and they caused plant injury. Acid lead arsenate alone or mixed with ferrous sulphate and lime, Paris green and powdered sulphur were so toxic to the plants that they were not tested on larvae. Replanting and reinfesting treated soil a year after the poisons had been applied gave similar results.

The fumigants were sprinkled over the surface of unplanted plots in which larvae in small cylindrical cages were distributed at known depths or were applied by sprinkling or injection into holes 3–4 ins. deep and 6 ins. apart to plots enclosed to a depth of 18 ins. below ground and covered with a cage, in which seeds of *P. taeda* had been sown. Adults were allowed to oviposit in the enclosed seed-beds, and larvae in the second and third instars were also introduced ; the fumigants were not applied until the larvae had caused serious injury to the seedlings. The effect of most of the fumigants on the plants was tested in uninfested plots of seedlings. All rates given are per 100 sq. ft. Undiluted carbon bisulphide injected at the rate of 1 U.S. pint gave the best results, and good control can be expected from it when it is properly applied. All caged larvae to a depth of 6 ins. and a third of those at 9–12 ins. were killed by this dosage, the percentage of seedlings killed by the larvae was reduced from 56·5 before treatment to 18·9 after it, and only 1·7 per cent. of the seedlings were destroyed by the chemical. Higher rates gave increased control but are not recommended owing to the increased risk and cost. Observations have shown that seedlings of *P. caribaea*, *P. echinata* and *P. palustris* are no more susceptible to injury by carbon bisulphide than *P. taeda*. Ethylene dichloride injected at the rate of 1 U.S. gal. killed all caged larvae to a depth of 12 ins., but is too expensive for general use ; a 50 per cent. emulsion injected at the rate of ½ U.S. gal. gave excellent control with negligible plant injury, but a 10 per cent. emulsion sprinkled over the surface at the rate of 25 U.S. gals. killed all the plants. A 50 per cent. emulsion of carbon bisulphide diluted to 1 : 400 and 1 : 200 and sprinkled over the soil at rates of 75 and 25 or 37·5 U.S. gals., respectively, gave fair control of caged larvae to a depth of 6 ins., but in naturally infested plots, enough larvae to cause considerable damage were present two months after the treatment. Plant injury in the test plots was not very severe, but under nursery conditions, the emulsion either puddled in localised areas, causing excessive scorching, or ran off the sloping seed-beds. Paradichlorobenzene injected at the rate of 2, 3 or 4 lb. gave fair control, but its action is too slow for immediate control ; it was of little value as a repellent. Dichloropentane (2–4 U.S. pints), liquid hydrocyanic acid (1–3 U.S. pints), calcium cyanide (1·5 lb.) and solutions of β, β-dichloroethyl ether gave little or no control.

The influence of soil temperature and moisture on the effectiveness of undiluted carbon bisulphide applied at the recommended rate was investigated in plots in which the soil was a mixture of sand and clay under sandy loam top soil 8–10 ins. deep. It was found that in order to obtain good control the temperature in the top 6 ins. of soil must be approximately 78°F. or more ; temperature changes within the range tested (55–90°F.) had little effect on the amount of plant injury. Variations in the normal moisture content of the soil (8–15 per

cent. total moisture) do not influence the toxicity to larvae or plants, but injury to the seedlings varies directly with changes above 15 per cent., and watering the seed-beds immediately before or after treatment results in high losses, though the mortality of larvae at the lower levels is increased. The fumigant must be injected to a depth of 3–4 ins. for effective action ; and its penetration varied inversely with the compactness of the subsoil. Its toxic action had almost disappeared after an hour.

LAMBERT (R.). **Les insectes forestiers du Québec en 1941.**—*Nat. canad.* **69** no. 8–9 pp. 173–205, 1 map, 10 graphs, 5 refs. ; also as *Contrib. Serv. Ent. Minist. Terres Québec* no. 15, 46 pp. Quebec, 1942.

In 1941 there was a further extension of the survey of insect pests of forests in Quebec [*cf. R.A.E.*, A **29** 431], and 6,574 samples were received, of which 3,932 were from spruce. Notes, arranged under the trees attacked, are given on the distribution of 44 species, and the parasites bred from many of them in the laboratory in 1938, 1939 and 1940 are recorded. Larvae of *Gilpinia hercyniae*, Htg. (*Diprion polytomum*, auct.) on spruce were only half as numerous on an average as in 1940, and severe defoliation occurred in only a few localities, though infestation spread somewhat north of the St. Lawrence. The chief agent of natural control was again the disease of the larvae [*cf.* **29** 432]. The only parasite bred was *Pimpla* (*Itoplectis*) sp. ; 147,200,000 examples of the Eulophid, *Microplectron fuscipenne*, Zett., were liberated. Severe weather rendered the second generation of the sawfly unimportant. An outbreak of *Harmologa* (*Archips*) *fumiferana*, Clem., occurred on spruce and balsam fir [*Abies balsamea*] in western Quebec [*cf.* **31** 134], and the infestation promised to be more serious in 1942. In some districts, 15 per cent. of the larvae were parasitised ; the only parasite bred in the laboratory was *Phaeogenes hariolus*, Cress.

LEECH (H. B.). **Black Flour Beetle, *Tribolium madens* Charp., in British Columbia (Coleoptera, Tenebrionidae).**—*Canad. Ent.* **75** no. 2 p. 40. Guelph, Ont., 1943.

The author reports that *Tribolium madens*, Charp., which has been recorded under bark or in decaying tree trunks in eastern North America [*cf. R.A.E.*, A **24** 493], is common in the southern interior of British Columbia, where in the spring of 1932 adults were observed attacking and killing the larvae of Bibionids in leaf mould under a log and were found inside the tops of beehives and under boards and stones nearby. The beetle has also been taken in British Columbia under the bark of pines and in wheat.

DE GRYSE (J. J.). **Note on *Marmara fasciella* Chambers.**—*Canad. Ent.* **75** no. 2 p. 40. Guelph, Ont., 1943.

Marmara fasciella, Chamb., has been found to construct long linear mines in the phloem of the trunk and branches of *Pinus strobus* and is probably distributed over the entire range of this pine in North America. The adults emerge between the last days of May and the first week in July and oviposit on the bark. The larva penetrates into the phloem through the underside of the egg, constructs about half of the mine during late summer and autumn and hibernates in it ; it resumes feeding early in spring, completes its mine in May or June, and spins its cocoon in the end of it under a loosened flap of bark. Apparently identical mines and larvae were found in *Abies balsamea* in Ontario and *Pinus monticola* in British Columbia, but no adults were reared from them. *M. fasciella* is heavily parasitised by species of *Copidosoma*, *Habrocytus* and *Elachertus*, *Hemiteles tenellus*, Say, and two species of *Pleurotropis*.

GOODHUE (L. D.). **Insecticidal Aerosol Production. Spraying Solutions in liquefied Gases.**—*Industr. Engng Chem* **34** no. 12 pp. 1456–1459, 6 figs., 15 refs. Easton, Pa., 1942.

The author describes a method of producing aerosols without heat, in which the insecticide, dissolved in a suitable liquefied gas in a closed container, is released through a spray nozzle; after being forced through the nozzle by its own pressure, the solvent forms the aerosol by evaporating rapidly, the heat of vaporisation being supplied from the atmosphere. The delivery tube must reach to the bottom of the liquid, since the solution and not the gas must be sprayed, and to avoid a coarse wet spray, the components of the solvent must be gaseous at temperatures considerably below that at which spraying is carried out.

An aerosol of pyrethrum extract and sesame oil, produced by spraying a solution of 5 gm. purified pyrethrum extract (20 per cent. total pyrethrins) and 2 gm. refined sesame oil in 93 gm. dichlorodifluoromethane, which has a pressure of nearly 90 lb. per sq. in. at room temperature, has proved effective against mosquitos and Muscid flies, and has considerable promise against adults of *Piophila casei*, L., which is a pest of stored meat and cheese [*cf. R.A.E.*, A **31** 22]. Preliminary tests showed that Sciarids and Phorids, which infest growing mushrooms in the larval stage, can be killed with about 400 mg. total pyrethrins and 800 mg. sesame oil per 1,000 cu. ft. Some irritation of the respiratory tract is caused by ordinary commercial pyrethrum extracts applied in aerosol form, but this appears to be due to a constituent other than the pyrethrins [*cf.* **29** 527] and was reduced in samples that were purified by molecular distillation.

Methyl chloride has a pressure of about 80 lb. per sq. in. at room temperature and will dissolve many more insecticides and is less expensive than dichlorodifluoromethane, but is weakly combustible and slightly toxic to man. In greenhouse tests of aerosols of various insecticides produced with this solvent against the cyclamen mite, *Tarsonemus pallidus*, Banks, the amount of methyl chloride required did not appear to injure plants.

A laboratory method of determining the settling rates of aerosols and sprays is described, and the settling rate of the dichlorodifluoromethane aerosol and one produced by spraying a similar solution of pyrethrum and sesame oil in deodorised kerosene on a hot plate and of the mist given by the second solution when it was sprayed through a standard Peet-Grady nozzle at a pressure of 12·5 lb. per sq. in. are shown on a graph. The aerosol produced by heat settled more slowly than the other, but both aerosols remained suspended much longer than the mist. Different types of nozzles, methods of spraying and materials influenced the settling rates in all cases.

ANDREWARTHA (H. G.). **Diapause in the Eggs of *Austroicetes cruciata*, Sauss. (Acrididae) with particular Reference to the Influence of Temperature on the Elimination of Diapause.**—*Bull. ent. Res.* **34** pt. 1 pp. 1–17, 21 refs. London, 1943.

In South Australia, the embryo of *Austroicetes cruciata*, Sauss., enters a state of diapause a few days after the egg is laid [*cf. R.A.E.*, A **30** 510, 511], during which development proceeds very slowly. Until a certain stage of development was reached, exposure to low temperatures ranging from 11·5 to 16·3°C. [52·7–61·34°F.] did not eliminate the diapause, while exposure to high temperatures of 30–40°C. [86–104°F.] inhibited development almost completely. Exposure for 100–150 days to moderate temperatures of 16–25°C. [60·8–77°F.] enabled the embryo to grow to a stage at which the diapause was eliminated by an adequate exposure to a suitable low temperature (*e.g.*, 13·5°C. [56·3°F.]). A similar stage of development was reached after exposure for 40 days to 25 and

10°C. [50°F.] on alternate days. In general, diapause was eliminated when the egg was exposed to an adequately low temperature for an adequate period, provided that the embryo was at a suitable stage of development. If the period at low temperature was inadequate, or if the embryo was not at a suitable stage when exposed to low temperature, diapause was only partly eliminated. In such cases, the exposure to low temperature resulted in an abnormal growth of the embryo when returned to a favourable temperature, and development was not completed. Diapause was eliminated most rapidly at temperatures between 6 and 13°C. [42·8–55·4°F.], whereas the embryo grew most rapidly at about 30°C. Below 13°C., growth practically ceased. The absence of overlapping of the temperature ranges for these two processes may account for the presence of diapause in *Austroicetes*. The occurrence of a less pronounced diapause in *Melanoplus differentialis*, Thos., may be due to partial overlapping of the temperature ranges for the two processes [*cf.* **25** 519], and the absence of diapause in *Locusta migratoria*, L. [**24** 229] may be explained on the assumption that the two processes in this species proceed over the same temperature range.

It is suggested that the elimination of diapause depends chiefly on the low temperature causing the yolk to undergo changes that make it more suitable for the nourishment of the embryo, while its physical properties are also modified in such a way that the embryo is able to move over its surface. Thus, diapause in *A. cruciata* may rest on a nutritional basis, as is the case with *Platyedra gossypiella*, Saund. [**28** 532] and *Loxostege sticticalis*, L. [**25** 58].

Benson (R. B.). **Studies in Siricidae, especially of Europe and southern Asia (Hymenoptera, Symphyta).**—*Bull. ent. Res.* **34** pt. 1 pp. 27–51, 17 figs., 32 refs. London, 1943.

The author shows that the ratios between lengths of ovipositor and forewing and between lengths of sawsheath and ovipositor are specific characters in Siricids and records in tables the mean ratios for 44 species, together with the data on which they are based. Keys are given to the genera of the world, the females of the European species of *Sirex* and *Urocerus*, and both sexes of those of *Tremex*; *Xeris*, the only other genus occurring in Europe, is represented there by a single species, *X. spectrum*, L., A key is also given to the females of *Eriotremex*, gen. n., which is erected for certain Indo-Malayan species previously included in *Tremex* and a new one, which is described.

S. noctilio, F., and *S. juvencus*, L., are recorded for the first time from North America, the former from central Ontario and the latter from Newfoundland and Labrador. *S. cyaneus*, F., has been regarded as native only to North America, but descriptions of *S. juvencus* by Konow and Ghigi demonstrate almost certainly that their material included also European specimens of *S. cyaneus*. In a discussion of the British Siricids, it is suggested that *U. gigas taiganus*, subsp. n., which is described from Finland, North Russia, Siberia and Japan, and a form of *S. juvencus* with entirely black antennae that is recorded from Labrador, Newfoundland, the Murman Coast and Scotland may be indigenous in the Caledonian forest.

A list of the Himalayan and Oriental Siricids other than those of the genus *Eriotremex* is appended; they include one new species and one new subspecies.

Nixon (G. E. J.). **A Synopsis of the African Species of *Meteorus* (Hym., Braconidae).**—*Bull. ent. Res.* **34** pt. 1 pp. 53–64, 12 figs., 2 refs. London, 1943.

This review is based on material received by the Imperial Institute of Entomology for identification and on the collection in the British Museum and contains descriptions and notes on the distribution of 15 species, nine of

which are new. A key to the females of these species and a list of four others unknown to the author are also included. Species for which host records are given are *Meteorus testaceus*, Szép., bred from *Laphygma exigua*, Hb., in Cape Province and also recorded from Natal and Uganda ; *M. margaroniae*, Wlkn., bred from *Margaronia dimorpha*, Janse, in Cape Province and also recorded from Zululand ; *M. lipsis*, sp. n., bred from *Parallelia pudica*, Möschler, in the Gold Coast, and a variety (var. A) of this species recorded from Sierra Leone and bred from *Achaea* sp. in the Gold Coast ; and *M. laphygmarum*, Brues, bred from *Heliothis armigera*, Hb. (*obsoleta*, F.) in the Anglo-Egyptian Sudan, *L. exigua* in Southern Rhodesia, and *L. exempta*, Wlk., in the Transvaal.

HARRIS (W. V.). **Termites in East Africa IV—Termites and Buildings.**—*E. Afr. agric. J.* **8** no. 3 pp. 146–152, 3 figs., 7 refs. Nairobi, 1943.

In this fourth part of a series [*cf. R.A.E.*, A **29** 590], the author discusses the habits of mound-building and subterranean termites in East Africa, where the species most commonly associated with damage to buildings are *Macrotermes* (*Bellicositermes*) *bellicosus*, Smeath., *Termes badius*, Hav., and *Microtermes redenianus*, Sjöst., in the first group and *Coptotermes amanii*, Sjöst., in the second. Only three records of attack by dry-wood termites, *Kalotermes* (*Cryptotermes*) *havilandi*, Sjöst., and possibly a closely related species, are known in East Africa, and since these are from ports in Kenya and Tanganyika, they are considered to be due to accidental introductions. Recommendations, based chiefly on the literature, are made for the clearance of sites and the construction of termite-proof buildings, and the importance is emphasised of using timber that is naturally resistant to attack, or rendered resistant by thorough chemical treatment, for construction and repairs and also for furniture in houses likely to become infested. Details are quoted of control in infested buildings by means of waste engine oil [*R.A.E.*, A **19** 315]. The termites can be repelled or destroyed by Paris green inserted into the runways as they are discovered or sprinkled along cracks through which they may be expected to appear.

JANISCH (R.). **Erfahrungen in der Erdflohbekämpfung.** [Experiences in the Control of Flea-beetles.]—*Kranke Pflanze* **20** no. 1–2 pp. 7–9. Dresden, 1943.

In a paper on the control of flea-beetles in Germany [*R.A.E.*, A **31** 121], Noll devoted more attention to dusts containing nicotine, derris or pyrethrum than to nicotine sprays. The author points out that sprays containing 0·1 per cent. nicotine are extensively and successfully used in East Prussia, where flea-beetles are serious pests of crucifers, that dusting apparatus is less common there than sprayers, and that derris and pyrethrum are scarce. Furthermore, Noll recommended a rate of application of about 72 gals. per acre, whereas one of 36–42 gals. is sufficient for horse-drawn sprayers and about 32 gals. for a knapsack sprayer.

DOLE (K. K.). **Observations on the insecticidal Properties of Mercury and its economical Use for the Prevention of Damage to stored Food Grains.**—*J. Univ. Bombay* (N.S.) **11** A pt. 5 pp. 116–120. Bombay, 1943.

The author briefly reviews work in India on the use of mercury vapour for the protection of stored grain from attack by insects [*cf. R.A.E.*, A **17** 235 ; **18** 29] and describes his own experiments in which the mercury was applied on sheets of copper, 1 by 1½ ft., about 0·4 gm. being required to coat each sheet on both sides. The sheets were kept in perforated paper boxes, to avoid loss through handling, and each was enclosed with 5 lb. husked rice or husked grains of *Panicum* sp. infested with eggs, larvae and adults of various Coleoptera in a tin box of which the lid was kept loosely closed except during inspection.

Periodical examination showed that all the smaller larvae were dead after a fortnight, but that some of the larger ones and all the adults were still alive after two months. All larvae and adults were then removed from the tins and treatment continued for a further two months, at the end of which no larvae or adults were present, showing that if any eggs were present they could not develop in the presence of mercury vapour. Eggs in untreated control samples hatched normally. The mercury did not affect the taste or smell of the grain.

ROARK (R. C.). **Insecticides for Control of Cotton Insects.**—*Chem. Engng News* **20** pp. 1169–1172, 4 figs., 17 refs. Easton, Pa., 1942.

The author gives lists of the principal insects that attack the cotton plant in the United States and of the insecticides mainly used for their control, with the estimated annual consumption of each. Calcium arsenate is used chiefly for the control of the boll weevil [*Anthonomus grandis*, Boh.], which is the most destructive pest and is estimated to destroy an average of 10 per cent. of the crop, but is also recommended against the cotton leafworm [*Alabama argillacea*, Hb.] and the bollworm [*Heliothis armigera*, Hb.]. The chemical and physical composition of commercial and other calcium arsenates is discussed in some detail, with the rates at which it should be used and methods of application. Fluorine seems to be the most promising substitute for arsenic in insecticides, and the results obtained in tests with a special light sodium fluosilicate [*R.A.E.*, A **16** 397] and a special calcium arsenate with a low arsenic content [**16** 398] are reviewed. Cryolite has been shown to be effective against *H. armigera* but only half as toxic to *Anthonomus* as calcium arsenate. Ordinary calcium arsenate diluted with an equal weight of hydrated lime is effective against light infestations of the weevil. Other insecticides dealt with include lead arsenate, which is applied as a spray against *Alabama argillacea*; Paris green, which is sometimes added to calcium arsenate for quick control of large larvae of *A. argillacea*, but is applied principally with dusting sulphur against the cotton fleahopper [*Psallus seriatus*, Reut.] and other Rhynchota; sulphur, which is effective against *P. seriatus* and the common red spider [*Tetranychus telarius*, L.] when applied alone and more effective against adults of *P. seriatus* when mixed with half its weight of calcium arsenate, the mixture also being of value against *Anthonomus*; and derris, cubé and nicotine sulphate, which are added to calcium arsenate to prevent the increase of Aphids [*Aphis gossypii*, Glov.].

The author points out that all these insecticides, with the exception of sulphur, are likely to become scarce in the United States, owing to war conditions, and that it is important that they should be applied as effectively and economically as possible.

PAPERS NOTICED BY TITLE ONLY.

LIZER y TRELLES (C. A.). *Pedronia festeriana* **n. sp.** (**Hom. Cocc. Pseudococ.**) [on a cactus, *Cereus aethiops*, in Argentina].—*Rev. Fac. Agron.* **10** no. 1 pp. 24–28, 3 figs., 4 refs. Buenos Aires, 1942.

JONES (T. H.) & MOSES (C. S.). **Isolation of** *Ceratostomella ulmi* **from Insects attracted to felled Elm Trees** [in New Jersey in 1936–39].—*J. agric. Res.* **66** no. 2 pp. 77–85, 2 figs., 3 refs. Washington, D.C., 1943. [*Cf. R.A.E.*, A **30** 180.]

GUNN (D. L.) & PIELOU (D. P.). **The Humidity Behaviour of the Mealworm Beetle,** *Tenebrio molitor* **L. III. The Mechanism of the Reaction.**—*J. exp. Biol.* **17** no. 3 pp. 307–316, 4 figs., 18 refs. London, 1940. [Recd. 1943.] [*Cf. R.A.E.*, A **29** 224.]

DADE (H. A.). **Colour Terminology in Biology.**—*Mycol. Pap.* no. 6, 21 pp., 2 charts, 4 refs. Kew, Imp. Mycol. Inst., 1943. Price 3*s.* 9*d.*

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